# SWELL :
## A Proposition for Coastal Metropolises in the Age of Rising Seas and Distributed Centralization

by

Talia H. Dorsey

A.B. Architecture
Princeton University, 1998

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARCHITECTURE
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

FEBRUARY 2006



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Thesis Supervisor :

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J. Meejin Yoon
Associate Professor

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Submitted to the Department of Architecture
on January 20, 2006 in Partial Fulfillment
of the Requirements for the
Degree of Master of Architecture

ABSTRACT

Premised upon the certain realities of the rise of urban sprawl, globalized dynamic networks, and sea levels, this thesis seeks to question these forces and mobilize the inherent potentials that lie within their intersections. Is contemporary urban form appropriate to contemporary urban culture? Do developing trends within network dynamics offer new potentials for spatial form? Does the forecasted flooding of coastal metropolises offer new grounds for such speculations? How might design begin to actively operate within such a scenario? Aligned within a tradition of visionary conceptions rooted in such considerations, this thesis project is a synthetic proposition of a new urban paradigm for dynamic water-based expansion – one driven by and resulting from the particularities of its contemporary cultural position.

Thesis Supervisor : Alexander d'Hooghe
Title : Assistant Professor of Architecture

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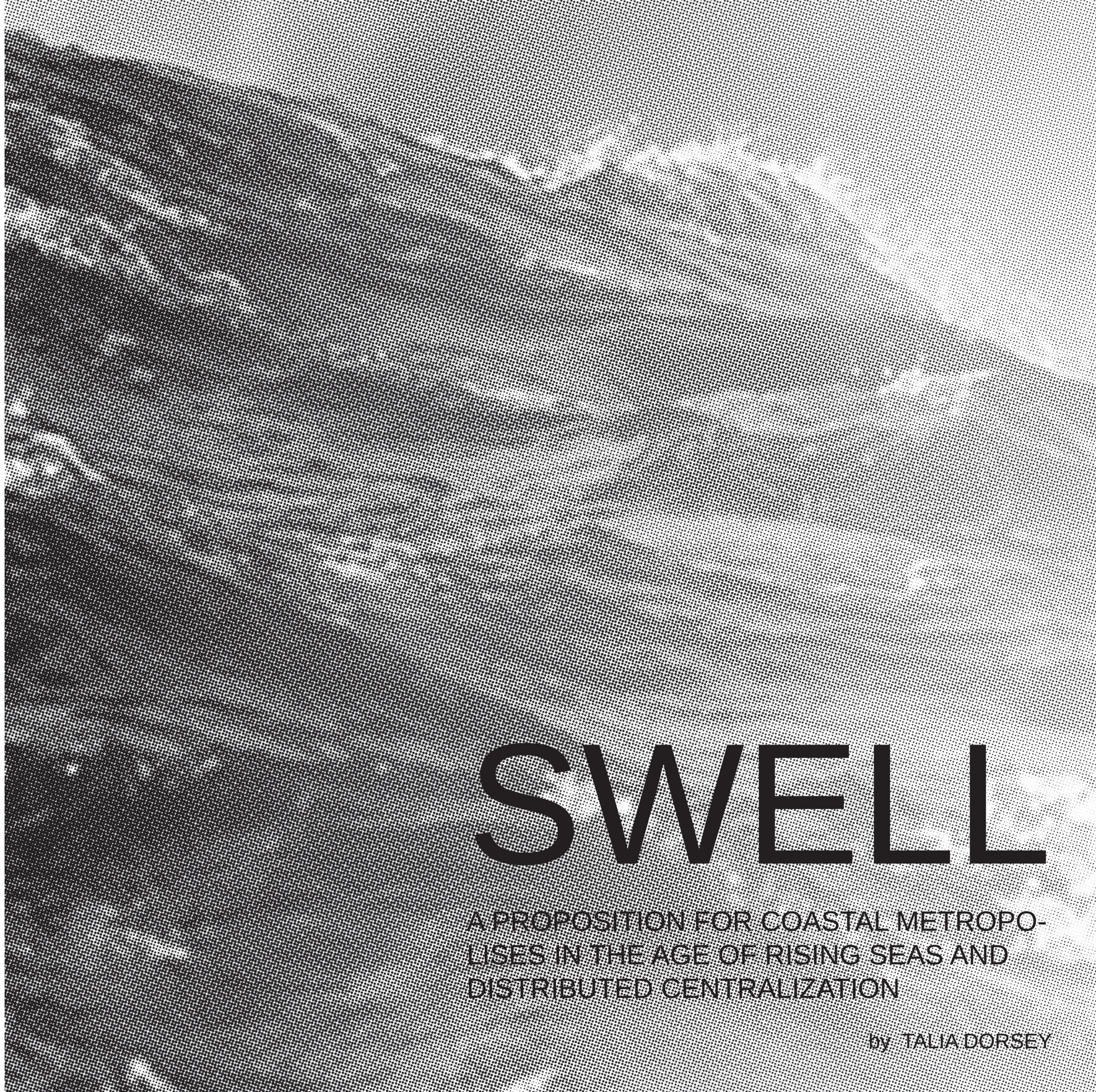

# SWELL

A PROPOSITION FOR COASTAL METROPOLISES IN THE AGE OF RISING SEAS AND DISTRIBUTED CENTRALIZATION

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thank you,
to all those that have informed my thought

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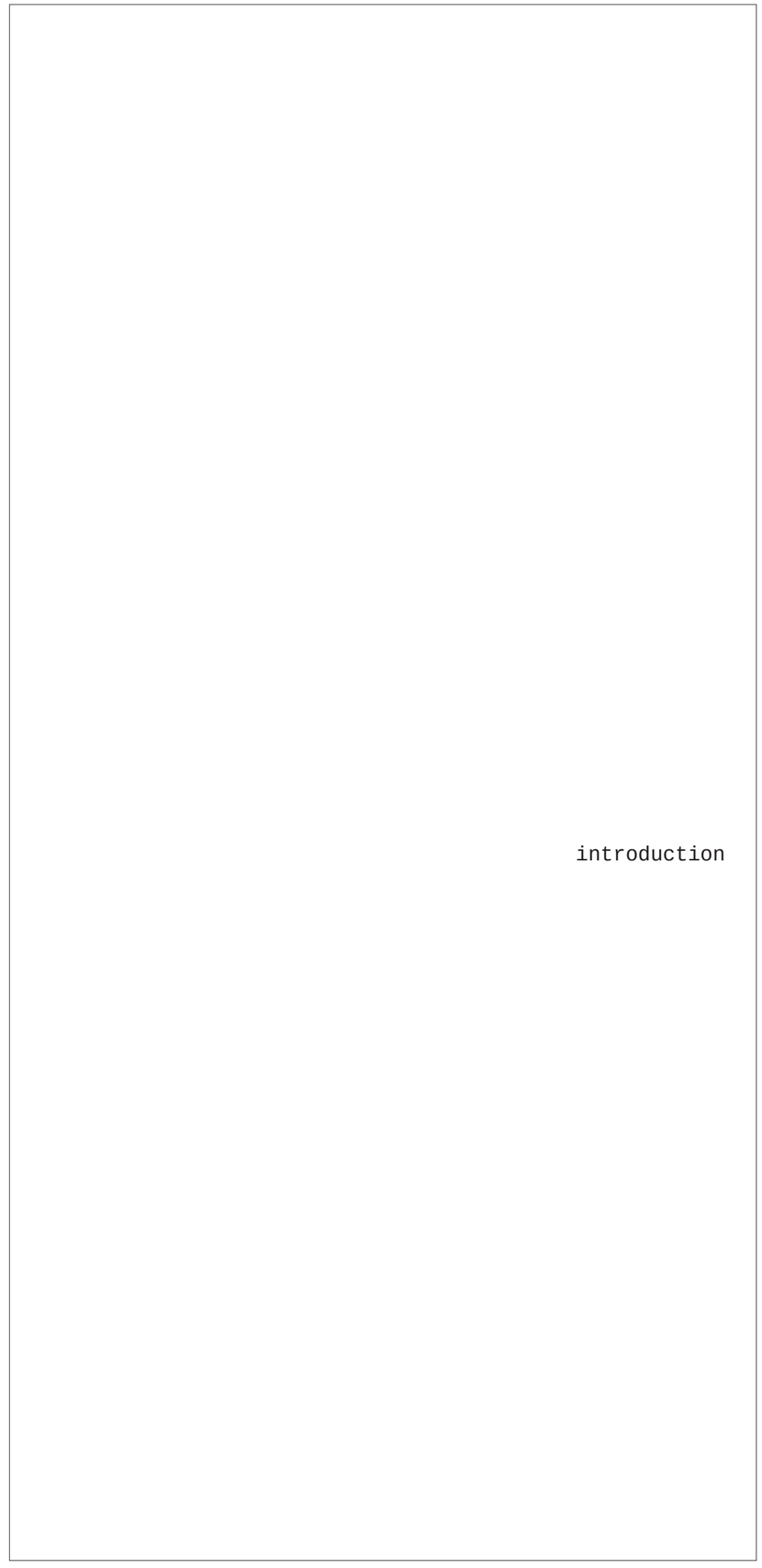

introduction

# STRATEGY

**preamble**

Within the multiplicitous threads that have woven the fabric of human civilization, arguably the most elemental are the orders of structure and will. Within this realm, societal evolution can be seen as the production of order through the centralizing will of the people, and conversely as the exertion of human will against and/or towards the implicit conditions of the structure of which it is a part. The particularity of this dynamic however, is that the locus of evolution can be situated within neither of these contiguous forces. It is exists only through the iterative and discursive dialogue that operates between them. It is precisely within this dialogue, in its contemporary form and disciplinary lineage, that I situate my thesis project. It is through the investigation and interpretation of the dialogue's contemporary orders and manifestations, in conjunction with the information held within the tradition of such investigations, that the thesis has been woven into being.

To further frame and explore the nature of this dialogue, I turn to a lexicon largely brought into the disciplinary tradition by Michel De Certeau ; specifically the dialectic of strategy and tactic[1]. While I do so in the knowledge of the socio-political association he has affected; I do so also for the reason that these two principles exemplify, elucidate and encompass the specific nature of the evolutionary dialogue of structure and will, well beyond De Certeau's ideological prescriptions. In order to ground this structural device, I turned to its etymological traces, and interestingly, one of the most fundamental nuances of its character and relevance within the context of societal evolution was rendered. The first cited use of the word strategy was to mean "a government or province under a strategus" (c. 1688)[2]. The people were themselves the strategy. However, as the word evolved, it came to mean "The art of a commander-in-chief; the art of projecting and directing the larger military movements and operations of a campaign." (c. 1810)[3] Thus, strategy evolved to be not the body any longer but the device by which the body could be structured/ordered. It is of course this latter definition that is most closely allied with our contemporary understanding of the word[4]. However, it serves as an interesting point of consideration, for it marks the departure and evolution from a state of ambiguity between body and governance, or will and structure, towards a more clearly defined distinction between the two within which strategy acts as an operative device.

Conversely, though one might guess that it was within the spectrum of strategy that the notion of tactics arose, the earliest citation of 'tactics' as we know it was more or less contemporaneous with the earliest cited definition of strategy (c.1626)[6]. Thus tactics as an operative mechanism actually predates strategy as such, and can be seen as implemental within its ideological evolution. The first citation of the latter

definition of strategy is in dialectic relation to tactic : “strategy differs materially from tactic; the latter belonging only to the mechanical movement of bodies, set in motion by the former.”[7] This definition, in recognizing the ‘material difference’ between the two, suspiciously resonates with the (contemporaneous) divide of body and device, will and structure.

Departing from the basis of these investigations, I have chosen to use the inherent sympathetic tendencies of these findings as an argument for the use of the strategy/tactics dialectic as an operative device within the project. Just as the notions of strategy and tactics operate within the analysis of societal evolution, so will they act as the iterative and operative mechanisms by which my project is informed, upon which it is founded and through which it is constructed.

**notes**

**1** Such a reframing can not be done without proper acknowledgement of De Certeau, and certainly his appearance as one of the first antagonists should be read as such. De Certeau is useful in inasmuch as he has so notably brought the discussion of tactics and strategy into the domain of cultural criticism. As such he will appear now and again as this antagonist throughout this discussion. Ultimately however, the oppositional relationship he posits between strategy and tactics – though admittedly tethered to his sociological/political biases – are a subset of a far more nuanced relationship that I here seek to explore and use as device. Thus, though his body of thought is well acknowledged, for the purposes at hand, I invite a step beyond that which he has circumscribed.

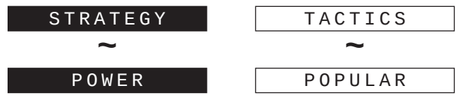
**2** Oxford English Dictionary : ”strategy”
1. A government or province under a strategus: cf. STRATEGIAN 1. Obs. rare1.
1688 MORDEN Geog. Rect., Armenia 343 Pliny accounted 120 Strategies Governments or particular Jurisdictions of every Province.

**3** Ibid.
2. a. The art of a commander-in-chief; the art of projecting and directing the larger military movements and operations of a campaign. Usually distinguished from tactics, which is the art of handling forces in battle or in the immediate presence of the enemy.
1810 C. JAMES Milit. Dict. (ed. 3) s.v., Strategy differs materially from tactic; the latter belonging only to the mechanical movement of bodies, set in motion by the former. 1825 J. A. GILBERT Expos. Princ. Milit. Comb. 11 The second combination is the art of bringing the mass of one’s forces as rapidly as possible on the decisive point of the primitive line of operation, or of the accidental line. It is what is vulgarly called strategy, but strategy relates only to the mode of executing this second combination. 1827 SCOTT Napoleon, View Fr. Rev. xi. II. 73 A brave and excellent soldier, but with no idea of strategie [sic] or tactics, save those current during the Seven Years War. 1889 A. T. MAHAN Sea Power Introd. 8 Before hostile armies or fleets are brought into contact (a word which perhaps better than any other indicates the dividing line between tactics and strategy).

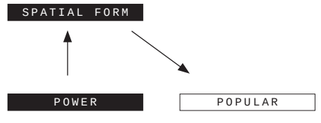
**4** Ibid.
b. an instance or species of this
d. In (theoretical) circumstances of competition or conflict, as in the theory of games, decision theory, business administration, etc., a plan for successful action based on the rationality and interdependence of the moves of the opposing participants;

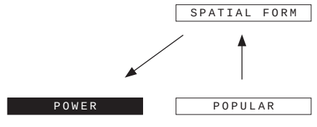
**6** 1626 GOUGE Serm. Dignity Chivalry §4 Martiall discipline, Artillery tacticks, and Military trainings are matters of moment.

**7** 1810 C. JAMES Milit. Dict. (ed. 3) s.v.








**operative design**

If we are to parallel the notions of structure and will with those of strategy and tactic, then we can begin to view society as the confluence of a governing power as structure and the deployed will of the populace as tactics. Power structures are thus the strategic devices developed and deployed as a means of ordering the complexity of the system, and populace currents the set of tactical maneuvres exerting or resisting the implicit conditions of the structures of which they are a part.

This operative domain of strategy and tactic is a discursive space, and as such, there exist the mediums or devices by which their exchange becomes possible. One such device is spatial form. Spatial form is particular however, in that it acts as both mediator and embodiment of these two governing forces. As the sociologist Manuel Castells writes :

> Space is not a “reflection of society,” it is society... Therefore, spatial forms, at least on our planet, will be produced, as all other objects are, by human action. They will express and perform the interests of the dominant class according to a given mode of production and to a specific mode of development. They will express and implement the power relationships of the state in an historically defined society. They will be realized and shaped by the process of gender domination and by state-enforced family life. At the same time, spatial forms will be earmarked by the resistance from exploited classes, from oppressed subjects, and from dominated women. And the work of such a contradictory historical process on the space will be accomplished on an already inherited spatial form, the product of former history and the support of new interests, projects, protests, and dreams. (p. 4)

Spatial form is thus the totalizing ‘expression and implementation of the power relationships of the state.’ This totality or embodiment however, is that of the relationship. Thus, spatial form has the implicit potential to act as either of the formative forces within this totality. On the one hand, spatial form can act as the strategic implementation of the ordering power towards the regulation of societal complexity. On the other hand it houses and serves the urban populace – proffering the physical frame upon and through which their tactics can operate, and furthermore towards the “support of new interests, projects, protests and dreams.” In this way can spatial form act as the ‘other’ within its operative domain – as strategy within tactical space to “express and perform the interests of the dominant class according to a given mode of production and to a specific mode of development”; and as tactic within strategic space, for ““[i]nto the institution to be served [can be] insinuated styles of social exchange, technical invention, and moral resistance.” (de Certeau, p. 26)

## operative context

To contemplate the design of spatial form as operative device, an understanding of the precise context in which it is to act must be undertaken. These contextual considerations are multifold and will be explored further throughout this work. However, the most primary of these is the societal context, for one of the primary mandates of this project is to act specifically within and through the mechanisms of contemporary society.

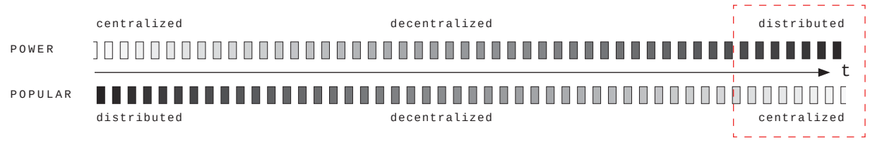
While the intricacies of the structure/will : power/popular dialectics are highly complex, certain generalized trends can be extracted. In his book *Protocol*, Alex Galloway describes such trends as a means of unpacking the implicit structures of the internet as an operative device. Though the object of his study differs from that here, its position as such a device does not, and thus his investigations of the contemporary context are highly relevant. He describes the ways in which power structures have manifested themselves (in the name of protocol) stating that "the diagram for protocol has shifted from the centralized to the decentralized network, and now finally to the distributed network." (p. 38) In other words, the method of power has successively shifted from a top-down centralized ruling system to an embedded distributed one.

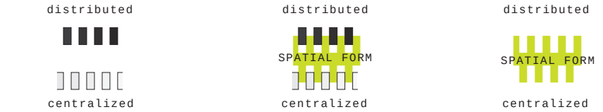
| ERA | FEUDAL/EARLY MODERN | MODERN | POSTMODERN, EMPIRE | THE FUTURE |
|---|---|---|---|---|
| **MACHINE** | PENDULA, LEVERS, PULLEYS | OIL, STEAM, NUCLEAR | COMPUTERS | BIOINFORMATICS |
| **ENERGY MODE** | SLAVE, VASSAL | WAGE LABOR | IMMATERIAL LABOR, INFORMATION | LIFE |
| **DISCIPLINARY MODE** | TITHE, FEUDAL, TRIBUTE | EFFICIENCY | DEBUGGING | THERAPY |
| **CONTROL DIAGRAM** | VIOLENCE | BUREAUCRACY | PROTOCOL | PHYSICS |
| **VIRTUE** | LOYALTY, ALLEGIANCE, SECRECY | PRESENCE, CENTRALIZATION, EFFICIENCY | FIDELITY, PATTERN, ALGORITHM | OPENNESS |
| **ACTIVE THREAT (RESISTANCE)** | ARMED REVOLT, SEDITION | SABOTAGE, TREASON | MUTATION, TERRORISM | IRRATIONALITY |
| **PASSIVE THREAT (DELINQUENCY)** | BETRAYAL, BLASPHEMY | RED TAPE, ENTROPY | RANDOMNESS, NOISE | SILENCE, NONEXISTENCE, IRRESPONSIVENESS |
| **POLITICAL MODE** | REVOLUTION | DISRUPTION | DISTURBANCE | HYPERTROPHY |
| **STRATAGEM** | LAND | TERRITORY, DETERRENCE | SECURITY, CONTAINMENT | PEACE |
| **PERSONAL CRISIS** | ABANDONMENT | PAIN, EMPTINESS | TERROR | CONTAGION, ERUPTION |

fig. 1 "Control Matrix", *Protocol*, p. 114-5

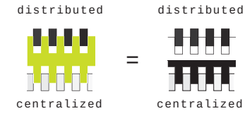
Such a shift however, in accordance with an understanding of its dialogic evolution, has been constantly informed through the popular use of the structure itself along with the technology of its deployment. Looking at the dynamics of this counter-force, its properties arguably imply an inverse shift, through its correlative empowerment, from a distributed mode to a centralized (or centralizing) one.

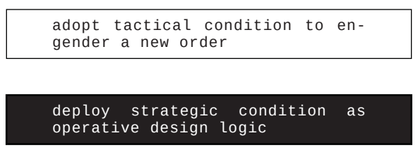
It is the potential of this latter condition (further detailed in part 2c) that this project seeks to exploit. The notion of spatial form as an operative system is thus considered within this contemporary context of distributed centralization of the power/will : strategy/tactic dialectic. Within this discursive space, the design of spatial form as an operative device must organize itself through its potential to deliberately operate both strategically and tactically itself.

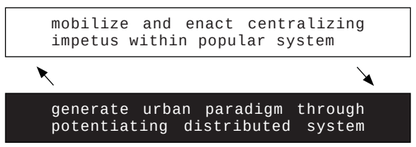









**design premise**

Within this project, design of spatial form, and in this case specifically urban form, is seen as having the potential to act both strategically and tactically within both the strategic and tactic space of its context. The strategy/tactic dialectic of the contemporary context into which it is inscribed is one of distributed and centralizing forces. The scheme is thus designed to act within and through these forces : acting within the tactic space to deploy its centralizing characteristic towards the engendering of a new urban order; and within the strategic space in its deployment of the distributed system as its operative logic. However, while the design of this project adopts specific characteristics of its context, these characteristics become newly qualified when understood as integral and operable within the design of urban form as an active device.

**design operation**

In light of the dialogic nature of the dialectic, the *behavior* of the strategic and tactical intents of the project must be understood - within the larger system of which they are a part as well as in relation to each other, In other words, if the tactical condition is adopted, then how does it operate tactically within the strategic condition and vice versa. While the dominant societal strategy has evolved into a model of distribution, its urban corollary has become that of sprawl. In recognition of the unsustainability of this trend - on multiple levels; environmental, social,and cultural, to name but a few - the centralizing impetus recognized within the tactical space becomes a critical operative. If this impetus exists within the societal system, can it be mobilized towards the generation of responsive urban form? Conversely, if this impetus has been enabled by the strategic condition of distributed control, can the design strategically implement this condition within the tactical domain such that it might translate into spatial terms?

**design paradigm**

The adoption of these strategic and tactical operations implies a new urban paradigm. This urban system is one designed for flexibility and one that is given structure through its use. Its organization is generated through the behavior of the units of which it is comprised, and attains its strategic intent through the desire and necessity of dense habitation. In return, the system offers flexibility and dynamism such that the centralizing nodes of urban culture are free to be reconfigured continuosly according to the shifting parameters of their generation. It is an urban system given structure through the flexibility of its parts. It is a design that exists through the characteristics and interrelationship of its constituent elements.

empower the discrete within the system to engender a new paradigm - infinitely operable according to its design of potential

Potentiate (flexible) consolidations within distributed design scheme along aspecific (fluid) lines of centralization

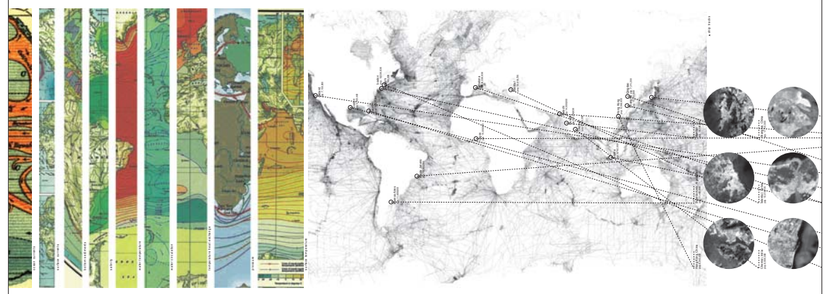
**design site**

Just as the design is grounded and plays within its socio-cultural context, so too must it within its physical terrain. Water is the territory for its own inherent set of potentials - both as tactic and strategic space. Highly political in its relationship to land, it operates as a critical strategic mass, rife with its own borders, rules, wealth and potential. Highly physical in turn, it operates as tactic space demanding a reconfiguration of the fundamental conceptions of urban dwelling. Upon and within this site, the design must respond and reap its conditions if it is to successfully operate within its socio-cultural domain.

adopt tactical condition as operative design parameters

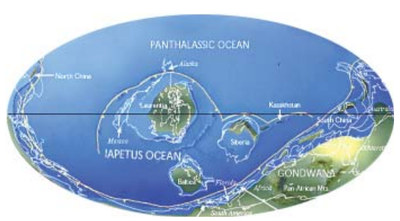
deploy strategic condition to support design

site 1 : world



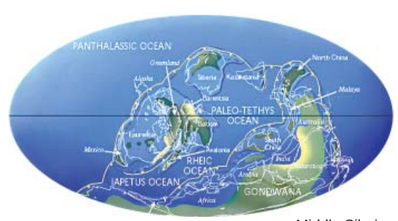
1960 1970 1980 1990 2000 2010


a. ..... Late Proterozoic
650 Ma

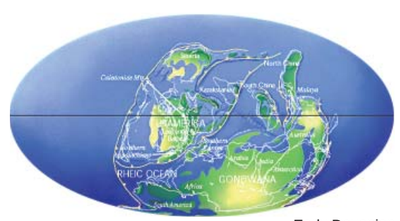



b. ..... Late Cambrian
514 Ma


c. ..... Middle Ordovician
458 Ma

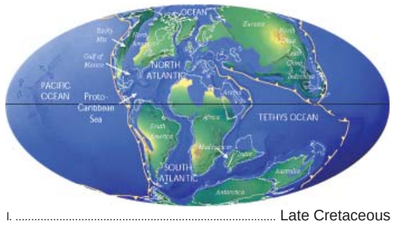



d. ..... Middle Silurian
425 Ma

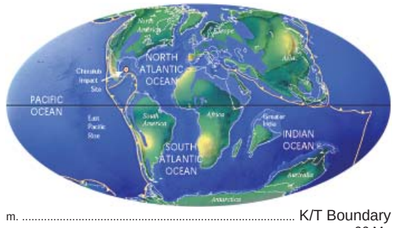



e. ..... Early Devonian
390 Ma


k. ..... Late Jurassic
152 Ma




l. ..... Late Cretaceous
95 Ma



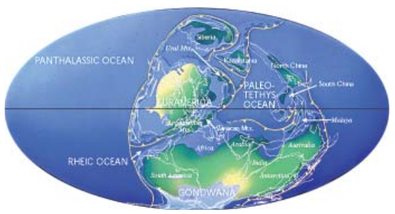

m. ..... K/T Boundary
66 Ma


n. ..... Middle Eocene
50 Ma

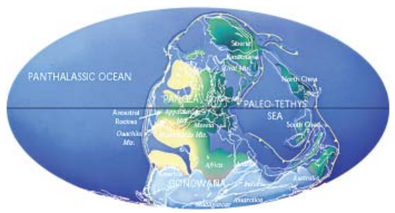

o. ..... Middle Miocene
14 Ma

fig. 1.1 Earth and Ocean History
Scotese, C.R. (2002)

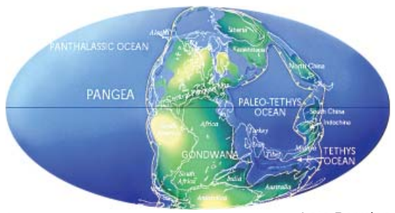
2010 — 2020 — 2030 — 2040 — 2050 — 2060



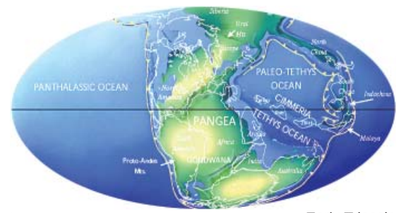

f. ..... Early Carboniferous
356 Ma



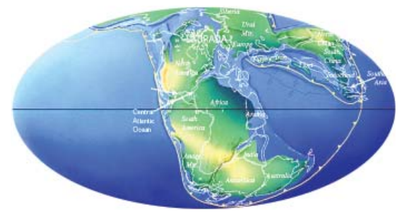

g. ..... Late Carboniferous
306 Ma



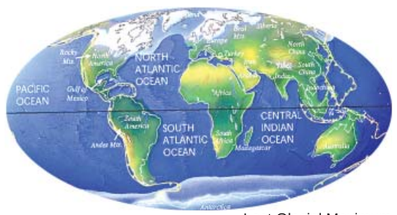

h. ..... Late Permian
255 Ma




i. ..... Early Triassic
237 Ma

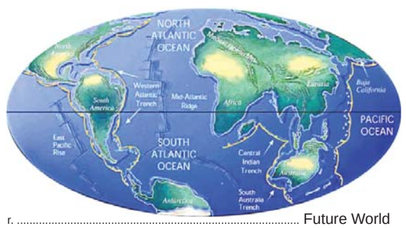



j. ..... Early Jurassic
195 Ma

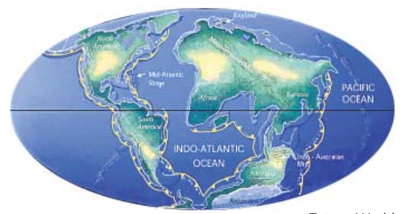



p. ..... Last Glacial Maximum
-18 000 yrs.


q. ..... Modern World
2005




r. ..... Future World
+50 Ma




s. ..... Future World
+150 Ma


t. ..... Future World
+250 Ma

1960 1970 1980 1990 2000 2010

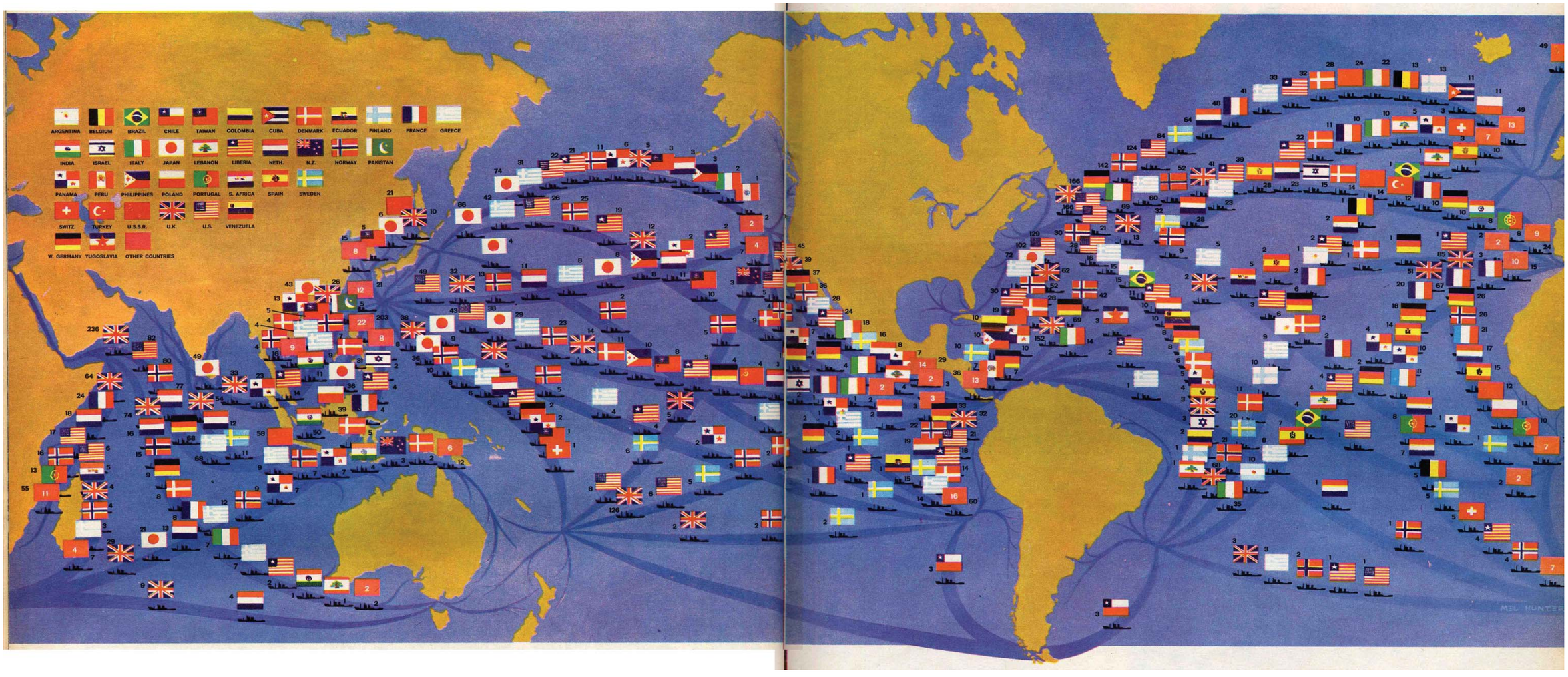



fig. 1.2 World Trade Routes 1963
"The Sea", *Life Magazine*, 1963

2010 2020 2030 2040 2050 2060

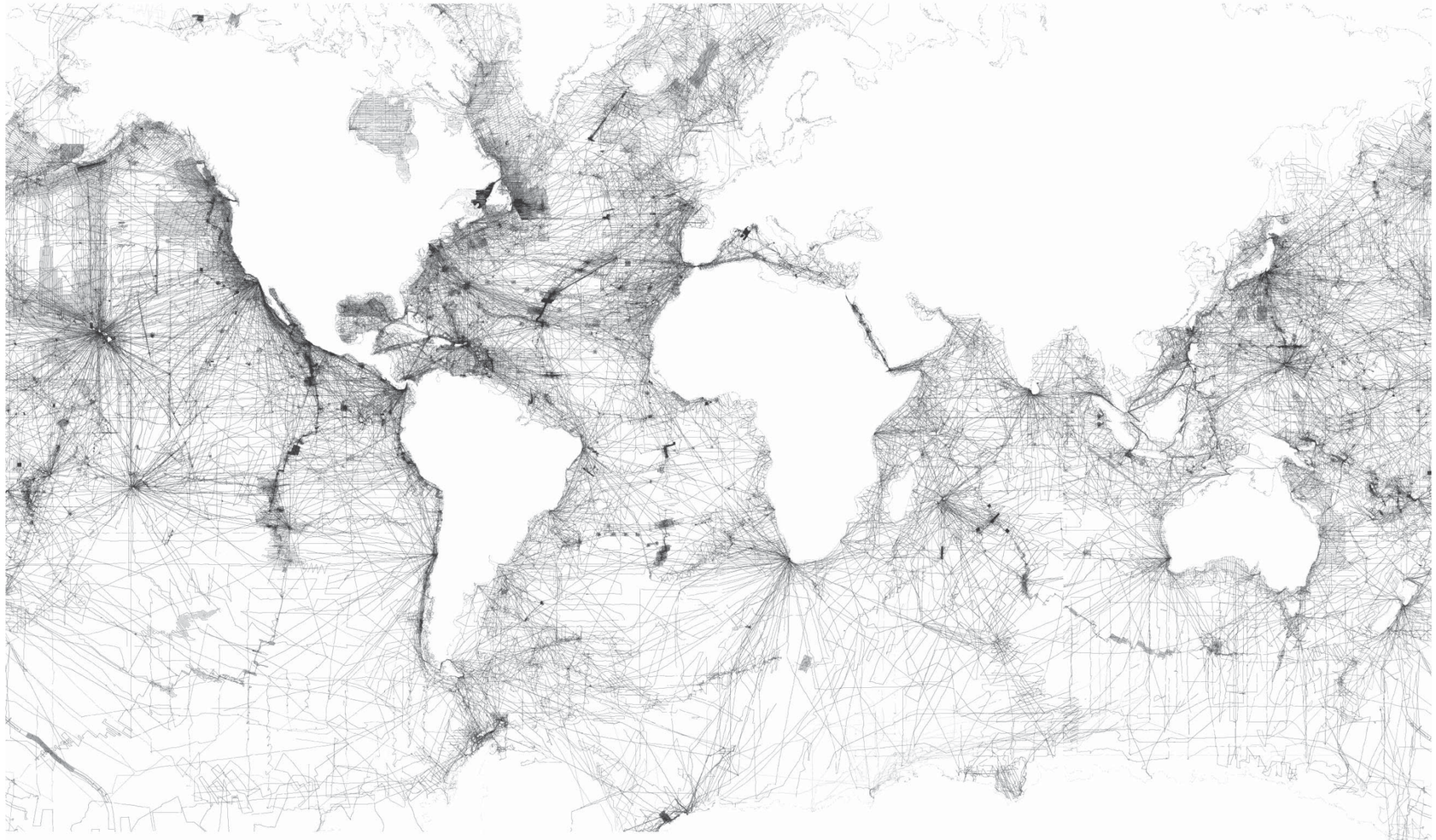
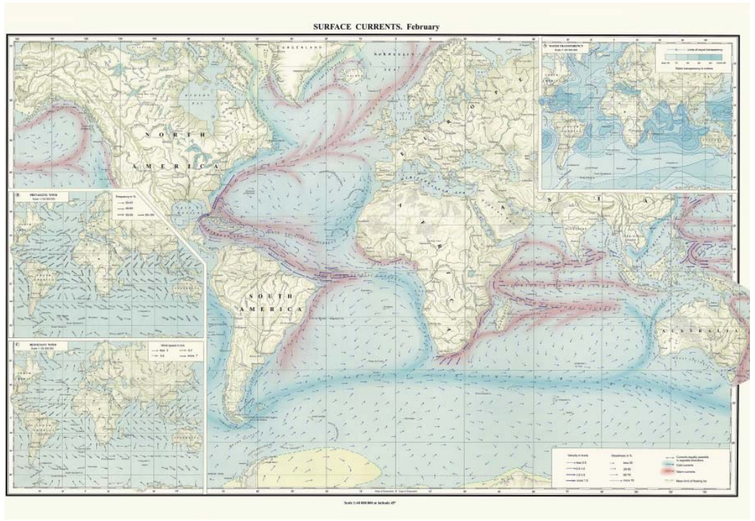


fig. 1.3 Ocean Ship Tracks
Walter H.F. Smith and David T. Sandwell, Ship Tracks, Version 4.0, SIO, September 26, 1996

1960 1970 1980 1990 2000 2010


fig. 1.4 Ocean Currents
UN Atlas of the Ocean



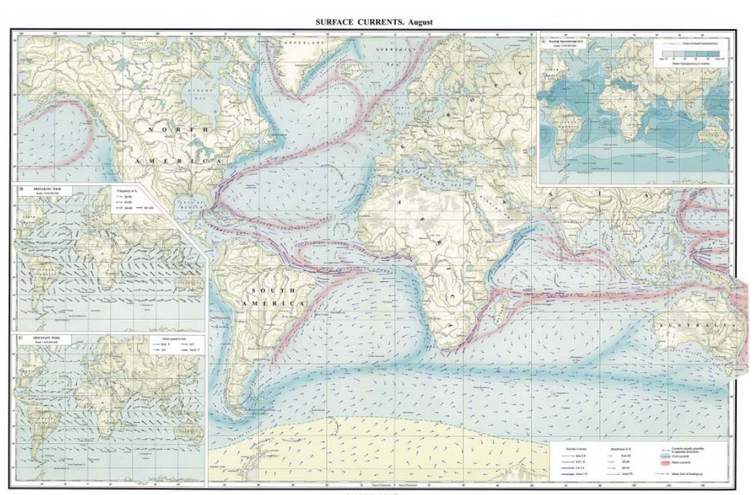
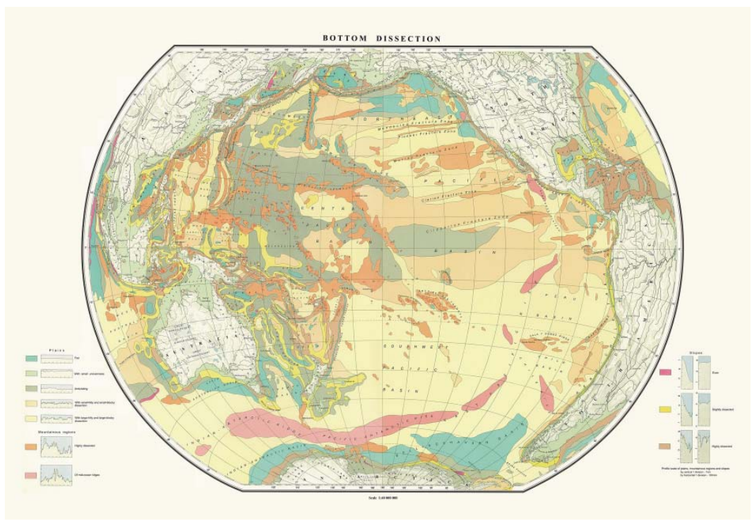




fig. 1.5 Surface Currents
UN Atlas of the Ocean



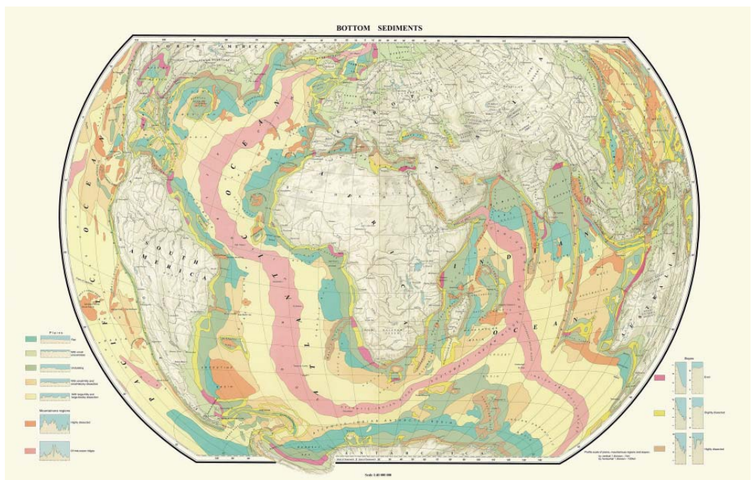
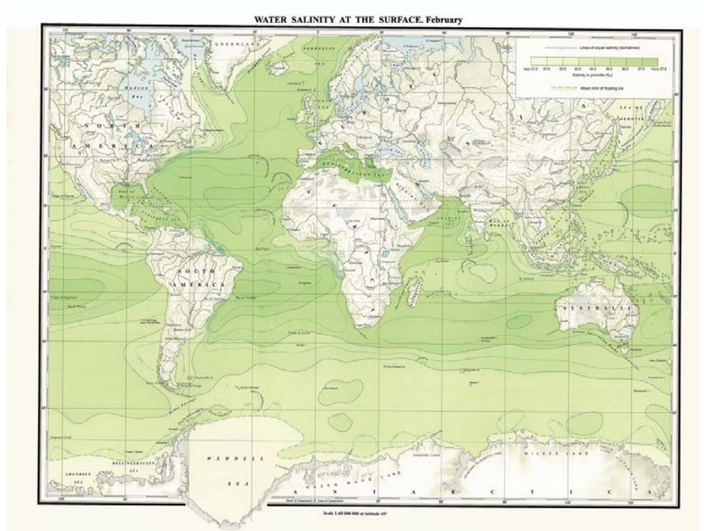




fig. 1.6 Bottom Sediments
UN Atlas of the Ocean

2010 2020 2030 2040 2050 2060



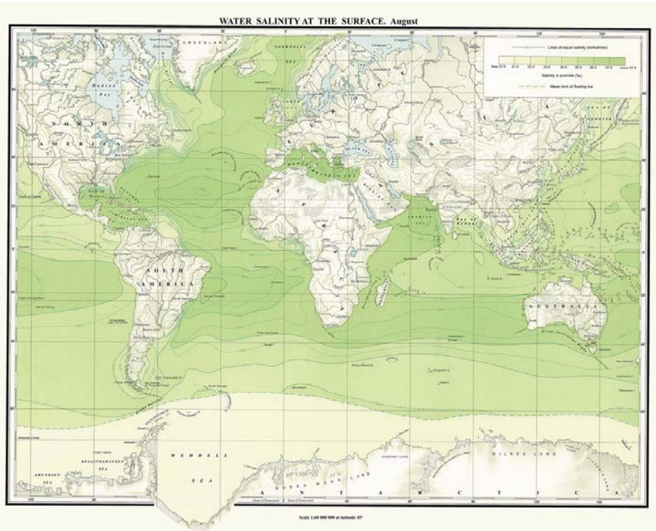
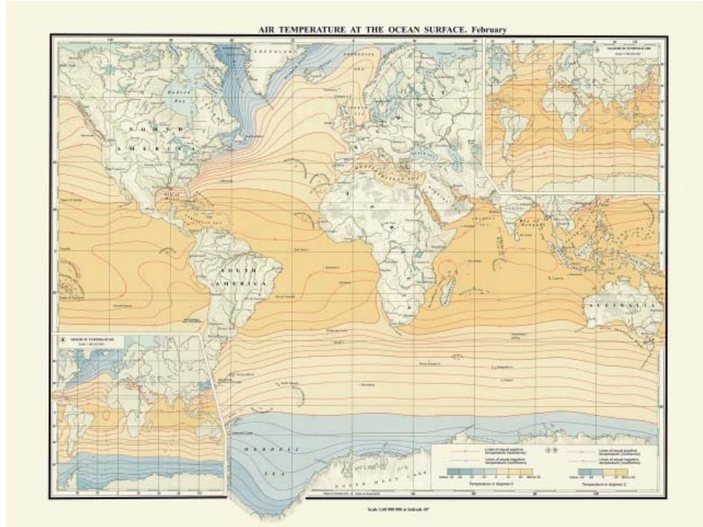




fig. 1.7 Water Salinity at the Surface
UN Atlas of the Ocean



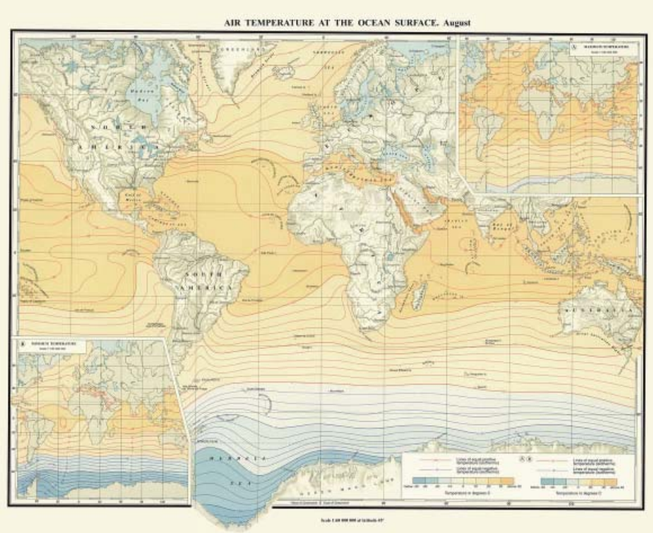
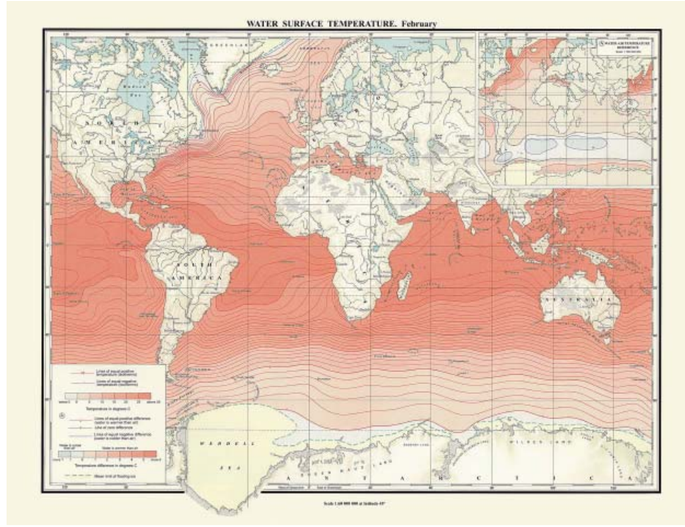




fig. 1.8 Air Temperature at Ocean Surface
UN Atlas of the Ocean



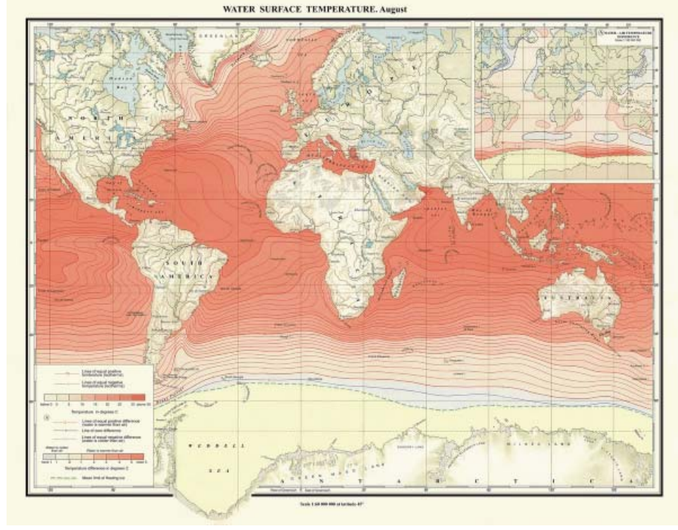




fig. 1.9 Water Surface Temperature
UN Atlas of the Ocean

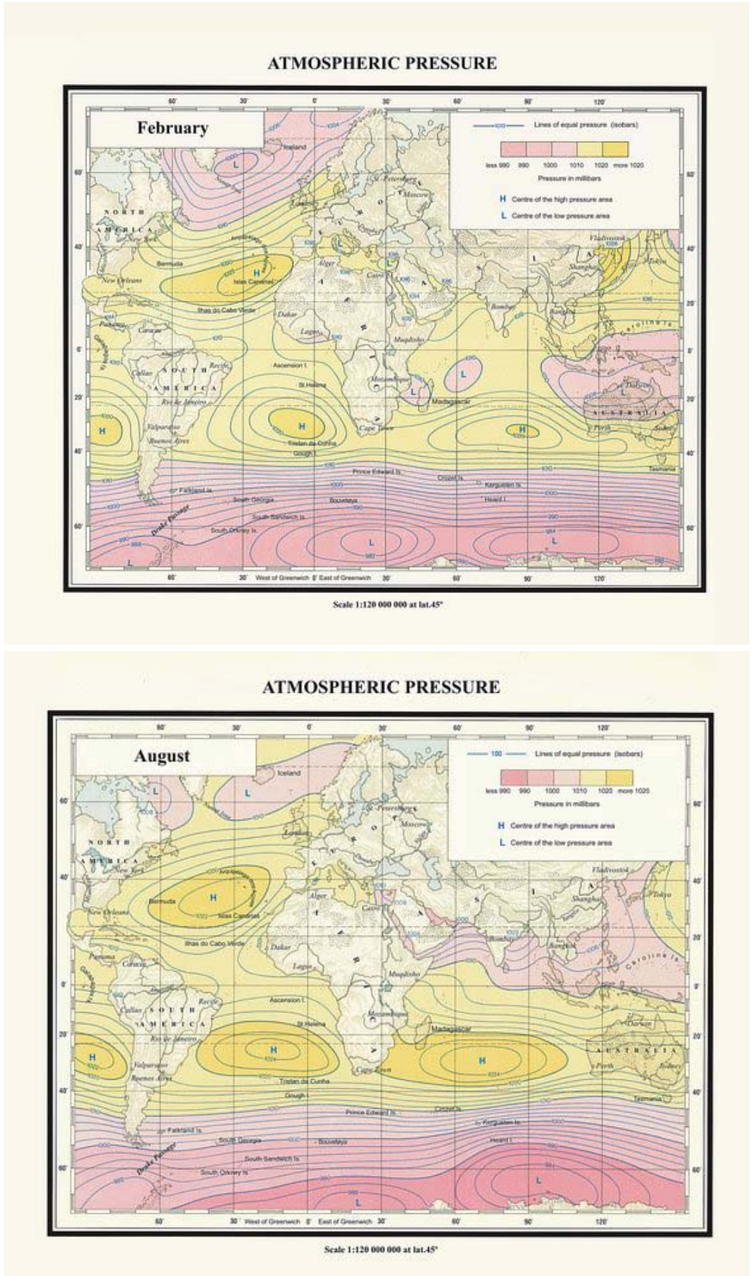



fig. 1.10 Atmospheric Pressure
UN Atlas of the Ocean

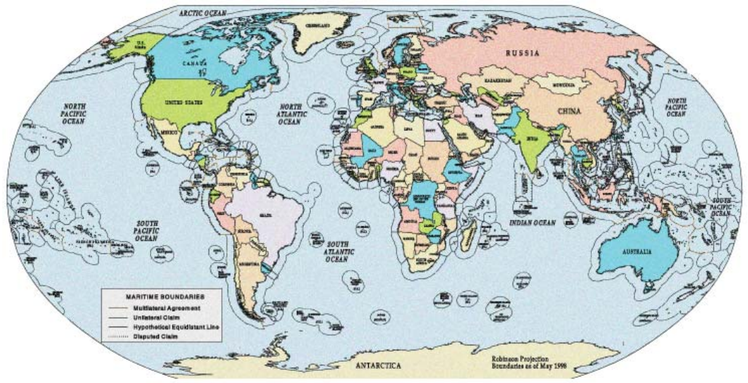



fig. 1.11 Maritime Boundaries
UNESCO Global International Waters Assessment Areas Map

2010 2020 2030 2040 2050 2060

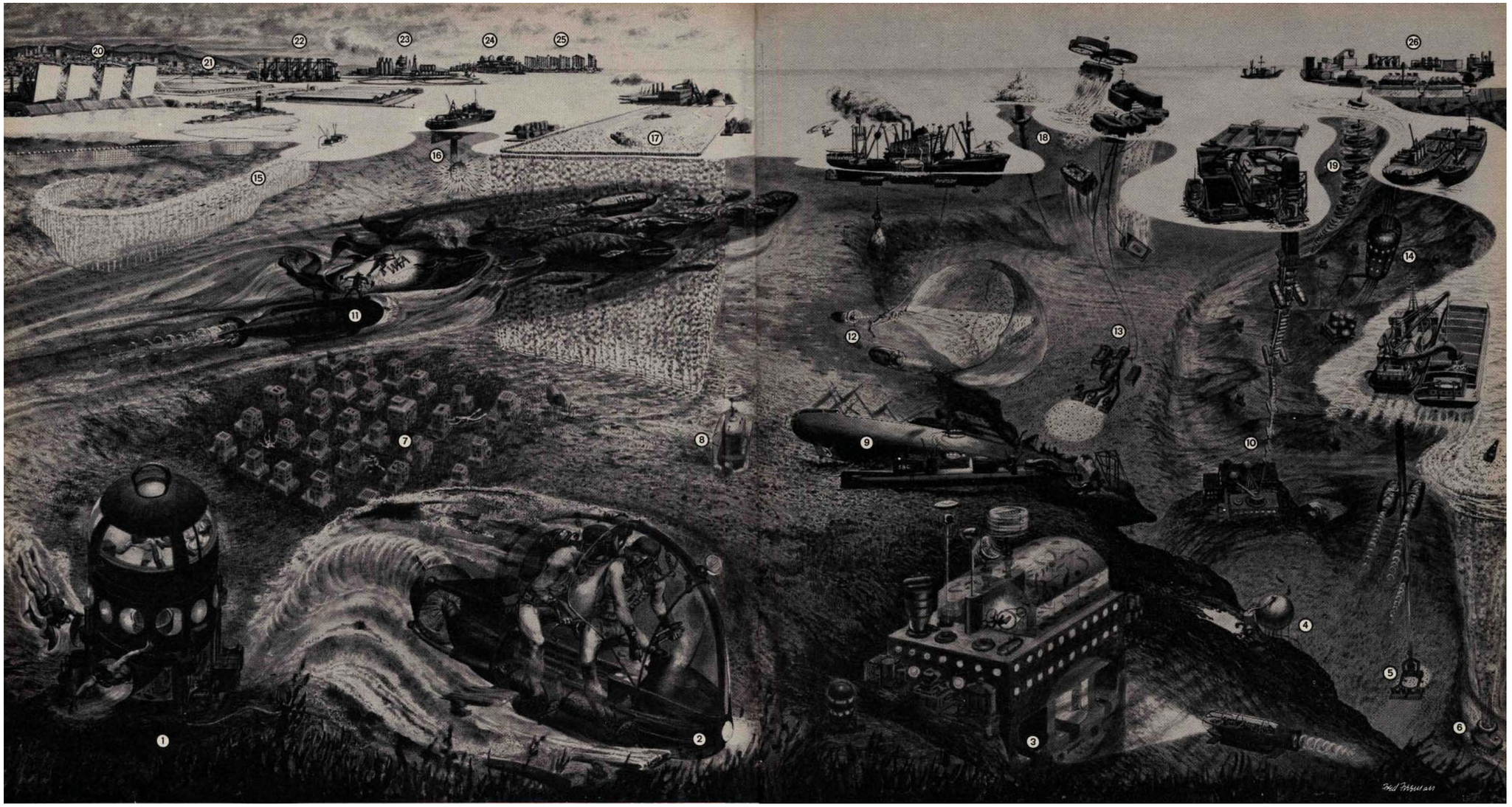
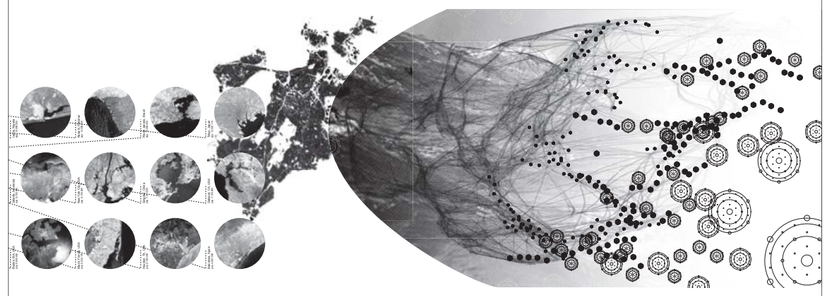
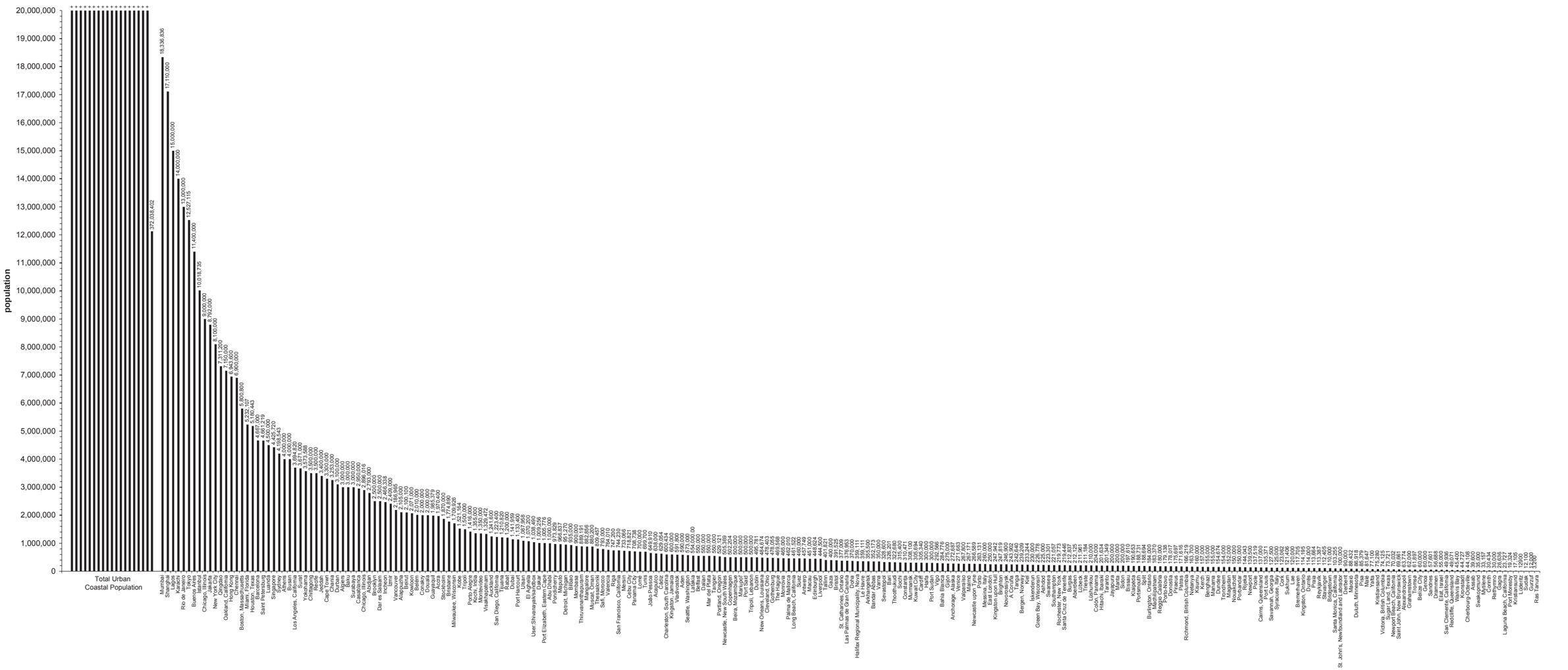



fig. 1.12 “Mining the Hidden Wealth”
*The Sea*, Life Magazine, 1963

site 2 : city




1960
1970
1980
1990
2000
2010
20,000,000
19,000,000
18,000,000
17,000,000
16,000,000
15,000,000
14,000,000
13,000,000
12,000,000
11,000,000
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
population
Total Urban Coastal Population
372,038,402
18,336,836
17,110,000
15,000,000
14,000,000
13,000,000
12,527,115
11,400,000
10,018,735
9,000,000
8,792,000
8,100,000
7,311,200
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6,900,000
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151,000
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150

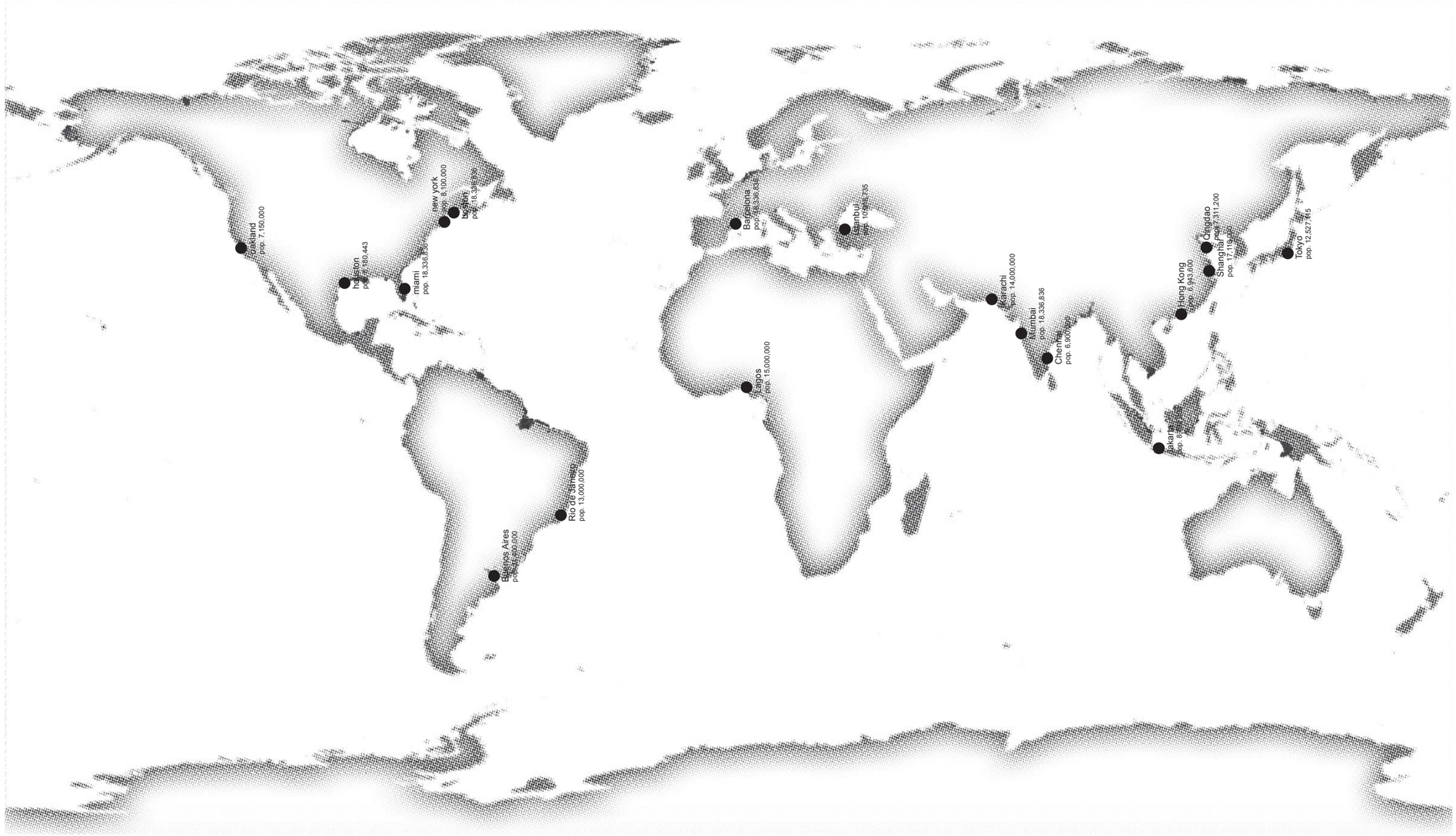
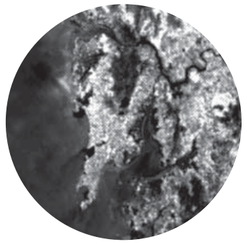
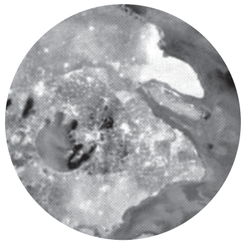



fig. 2.2 Coastal Metropolitan Geography
data : UN World Population Prospects: The 2004 Revision)

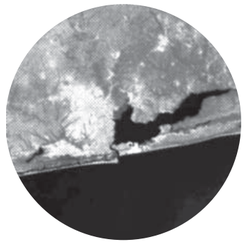
1960 1970 1980 1990 2000 2010



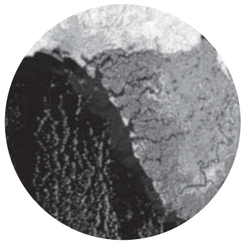
Mumbai
pop. 18,336,836



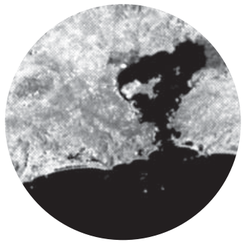
Shanghai, China
pop. 17,110,000



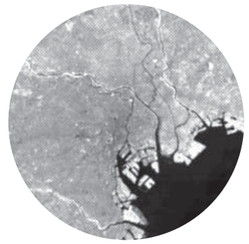
Lagos, Nigeria
pop. 15,000,000



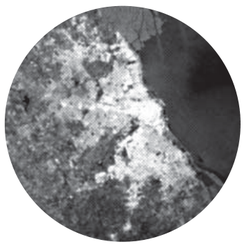
Karachi, Pakistan
pop. 14,000,000



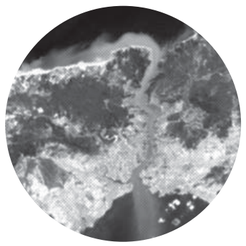
Rio de Janeiro, Brazil
pop. 13,000,000



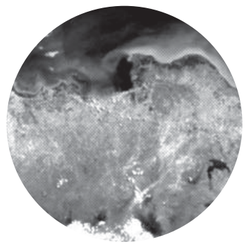
Tokyo, Japan
pop. 12,527,115



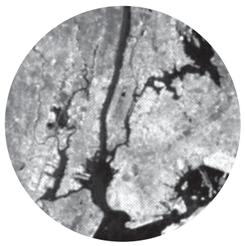
Buenos Aires, Argentina
pop. 11,400,000



Istanbul, Turkey
pop. 10,018,735

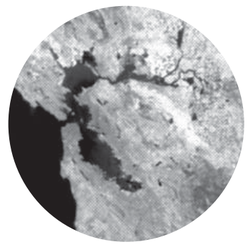


Jakarta, Indonesia
pop. 8,792,000

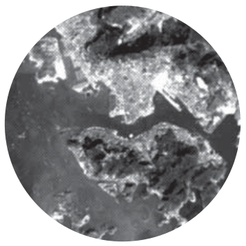


New York , NY, USA
pop. 8,100,000

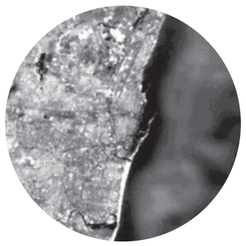
Qingdao, China
pop. 7,311,200



Oakland, CA, USA
pop. 7,150,000



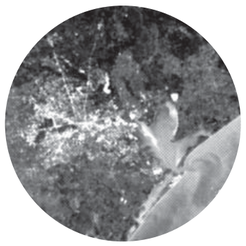
Hong Kong, China
pop. 6,943,600



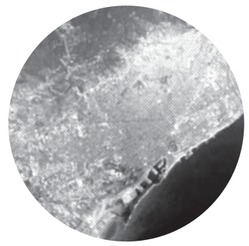
Chennai, India
pop. 6,900,000

Boston, MA, USA
pop. 5,800,800

Miami, FL, USA
pop. 5,232,107



Houston, TX, USA
pop. 5,180,443



Barcelona, Spain
pop. 4,667,000

fig. 2.3 Coastal Metropolitan Interface
various sources

2010 2020 2030 2040 2050 2060


Mumbai, India


Shanghai, China


Lagos, Nigeria


Karachi, Pakistan


Rio de Janeiro, Brazil


Tokyo, Japan


Buenos Aires, Argentina


Istanbul, Turkey


Jakarta, Indonesia


New York, NY, USA


Qingdao, China


Oakland, CA, USA


Hong Kong, China


Chennai, India


Boston, MA, USA

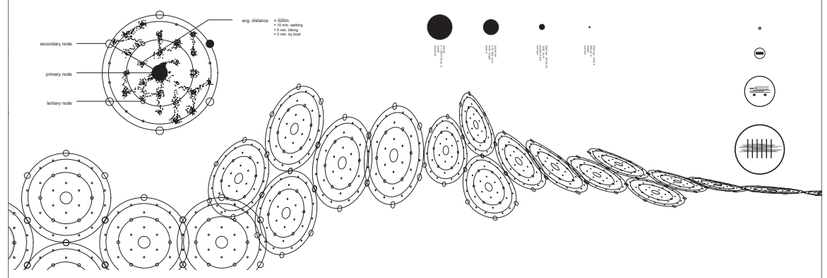

Miami, FL, USA


Houston, TX, USA


Barcelona, Spain

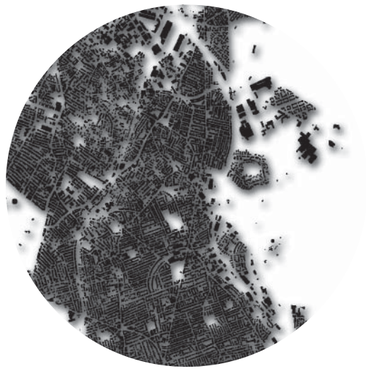
fig. 2.3 Coastal City Interface
various sources

# site 3 : form


secondary node
primary node
tertiary node
avg. distance
= 500m
= 10 min. walking
= 5 min. biking
= 2 min. by boat

1960 1970 1980 1990 2000 2010

fig. 3.1 City / Dwelling Dynamic



power

wind energy

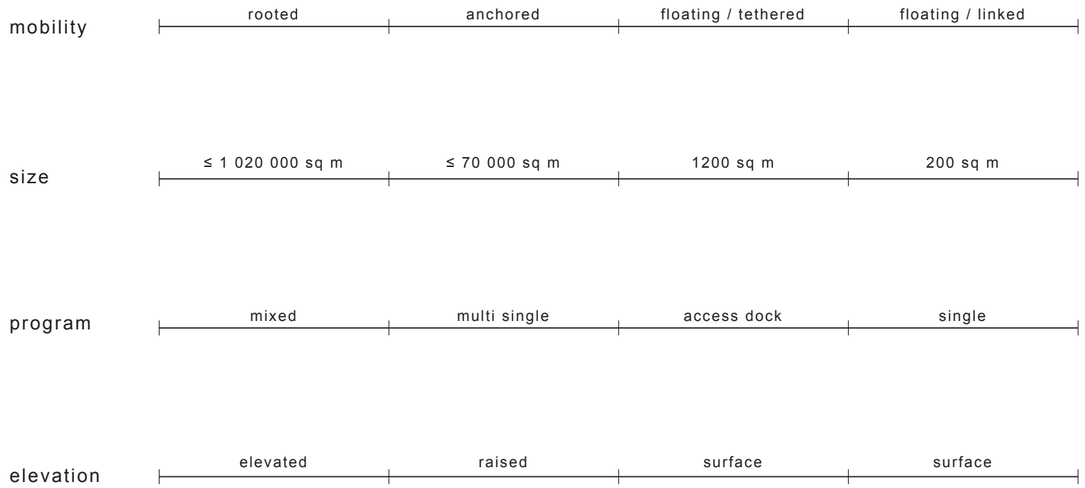
solar energy

wind energy

water

2010 2020 2030 2040 2050 2060

fig. 3.2 Nodal characteristics



1960 1970 1980 1990 2000 2010

fig. 3.3 Growth Nodes

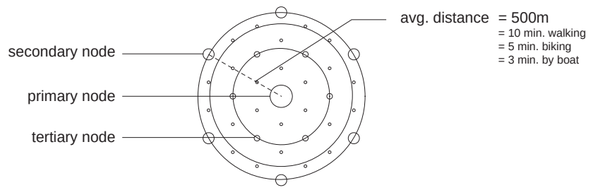
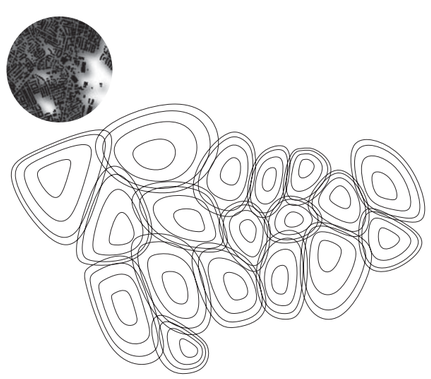
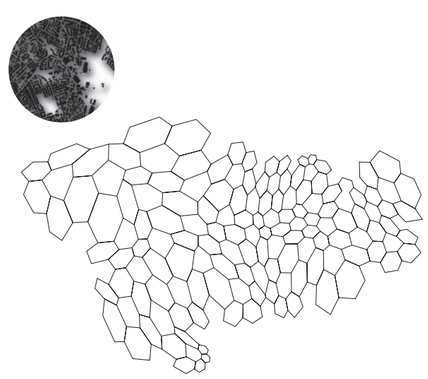


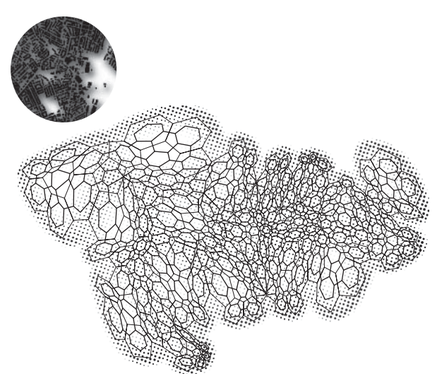

fig. 3.4 (prototyupical) Urban Growth Structure



a. .....affected growth rings

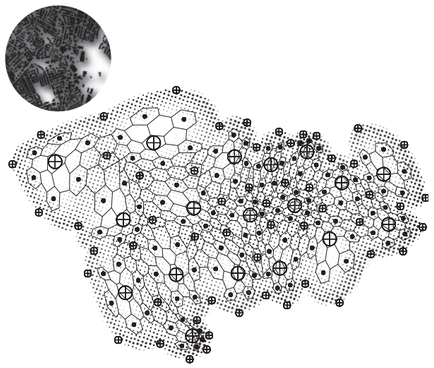


b. ..... implicit secondary nodal structure

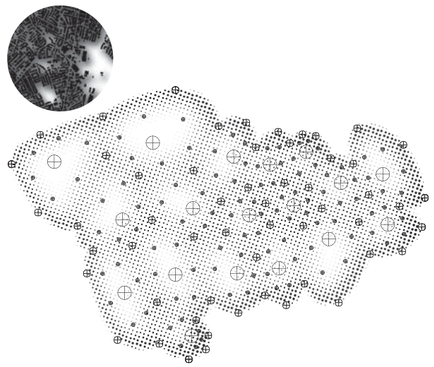


c. ..... implicit tertiary nodal structure

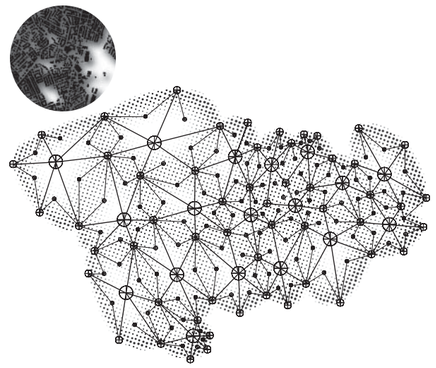
2010 — 2020 — 2030 — 2040 — 2050 — 2060



d. ..... nodal structure



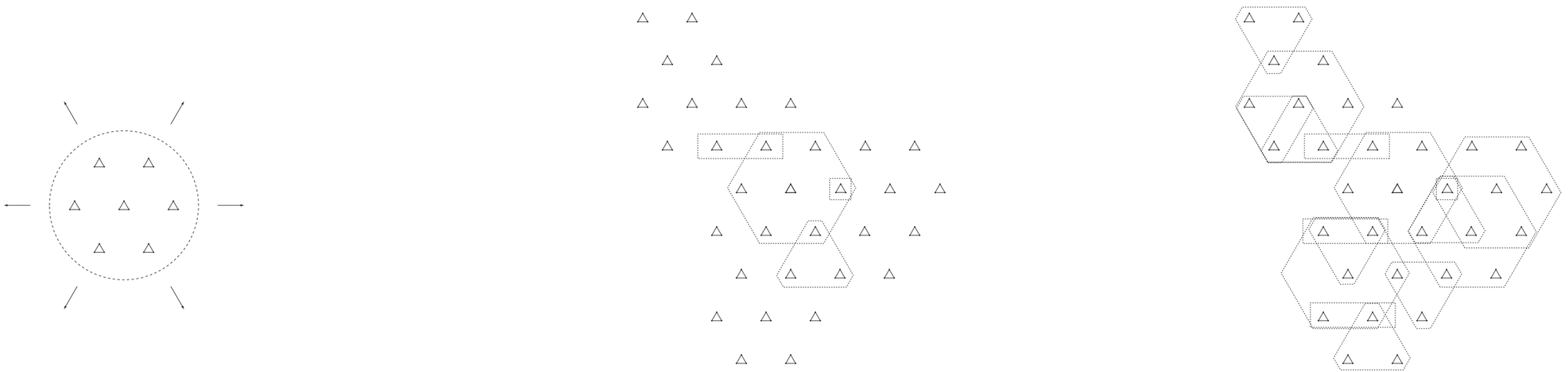
e. ..... nodes

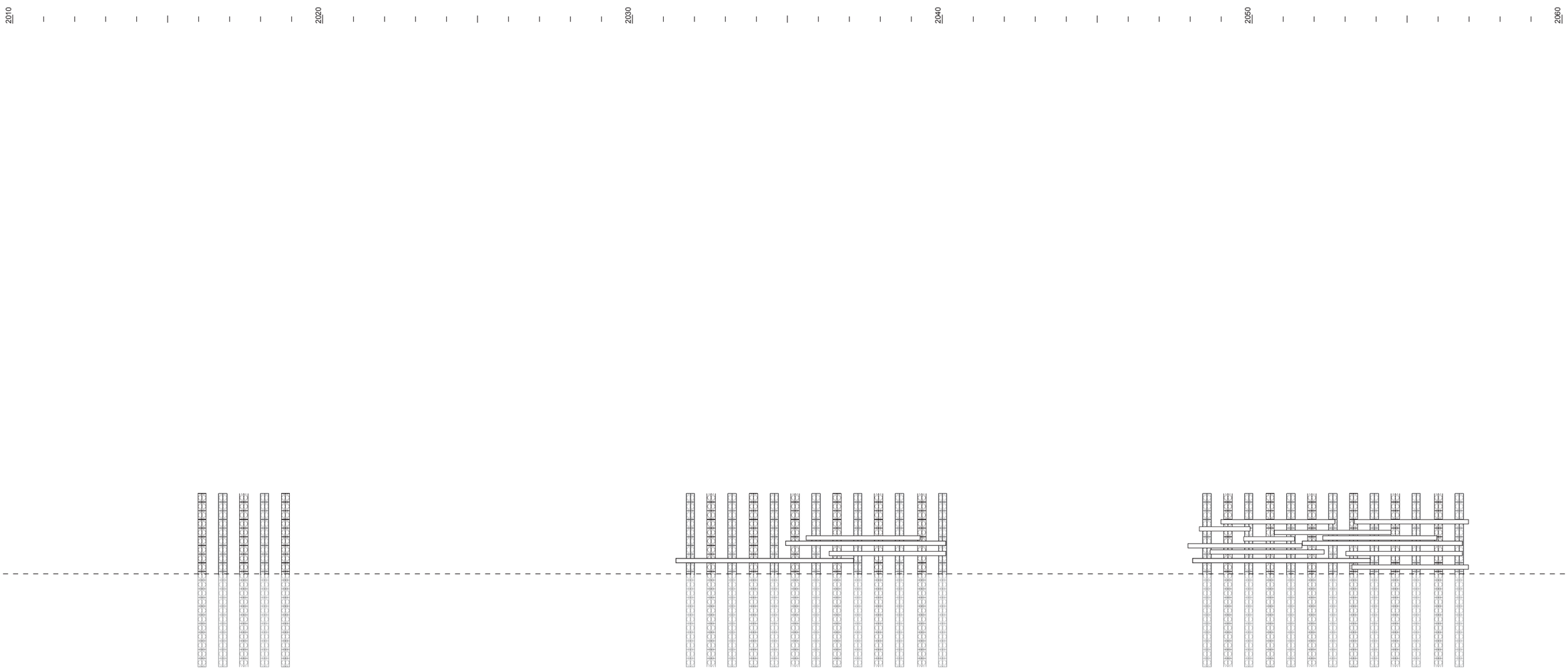


c. ..... internodal paths

1960 1970 1980 1990 2000 2010

fig. 3.5 Primary Densification Process




2010
2020
2030
2040
2050
2060

1960 1970 1980 1990 2000 2010

fig. 3.6 Nodal Development

primary node

platform module type 1

platform module type 2

platform module type 3

platform module type 4

modular infill units

transportation dock (air)

transportation dock (ground)

transportation dock (water)

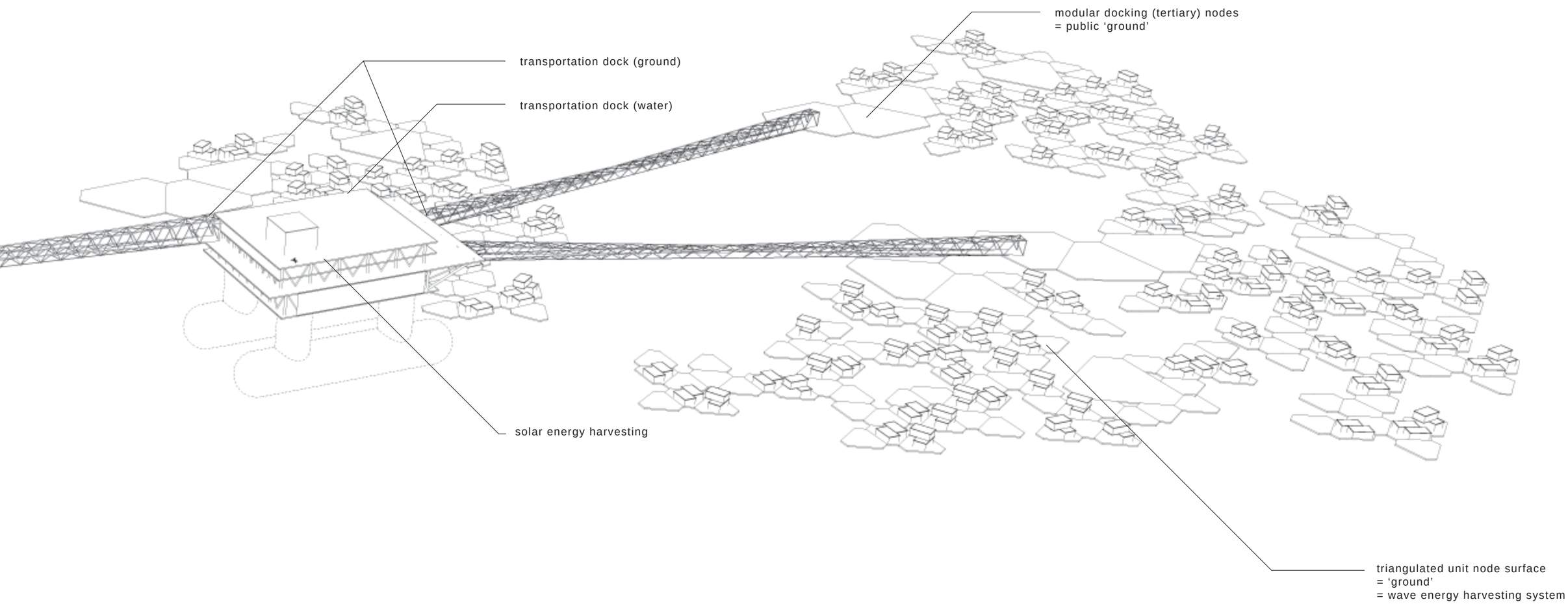
desalination tanks

2010 2020 2030 2040 2050 2060

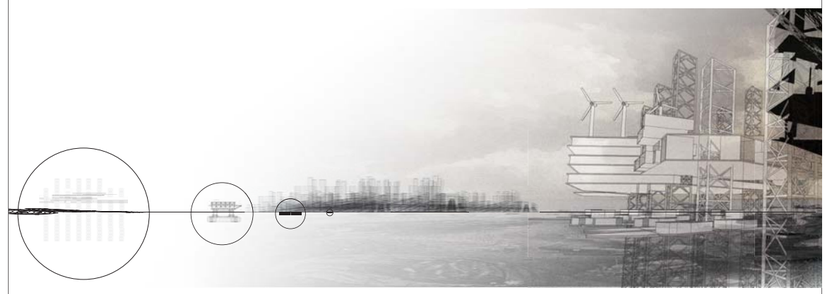
secondary node

tertiary node

unit node

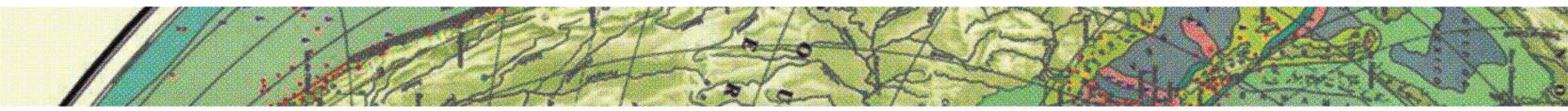


site 4 : dwelling

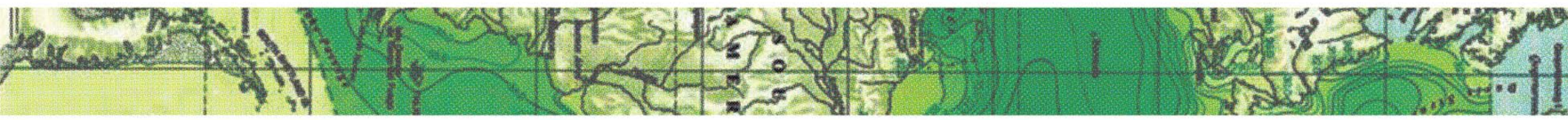


ocean currents

surface currents

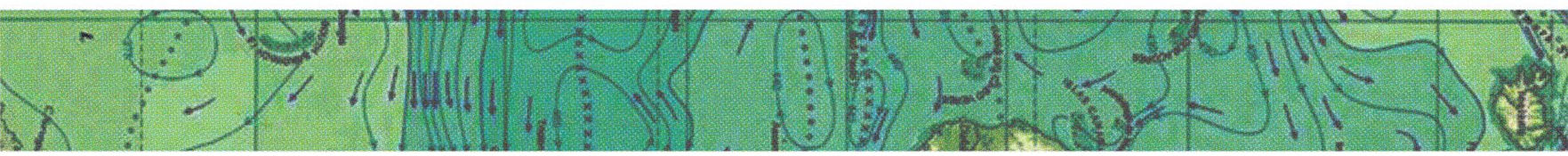


bottom sediments



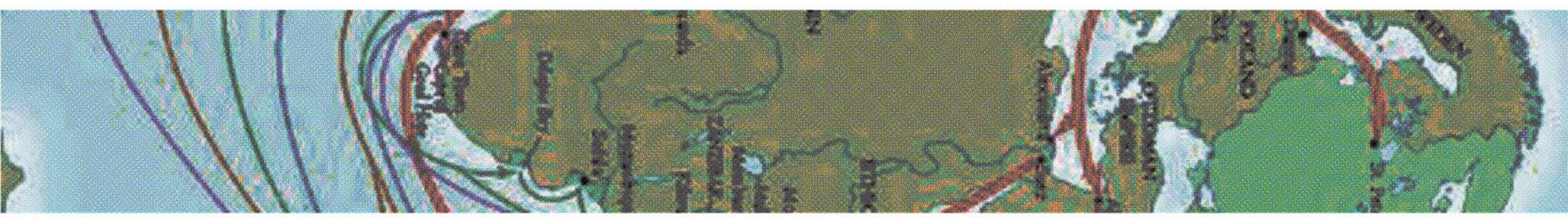
salinity

water temperature

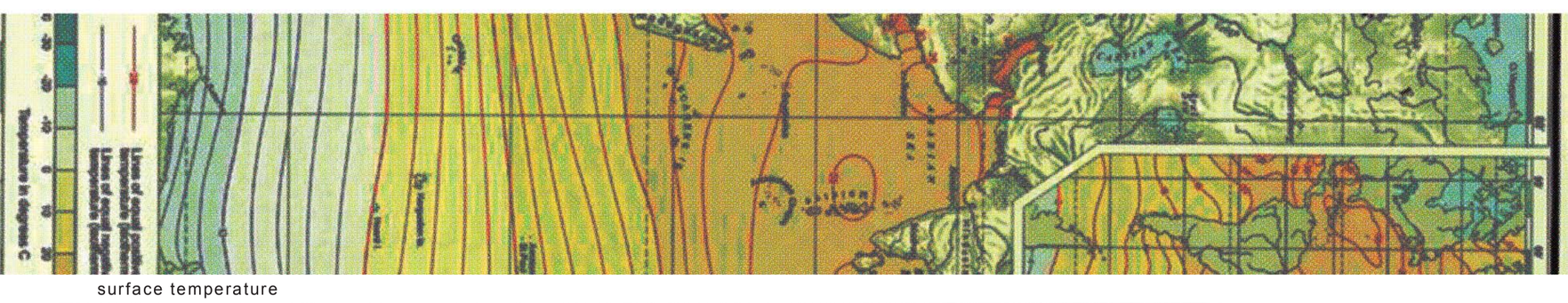


water circulation

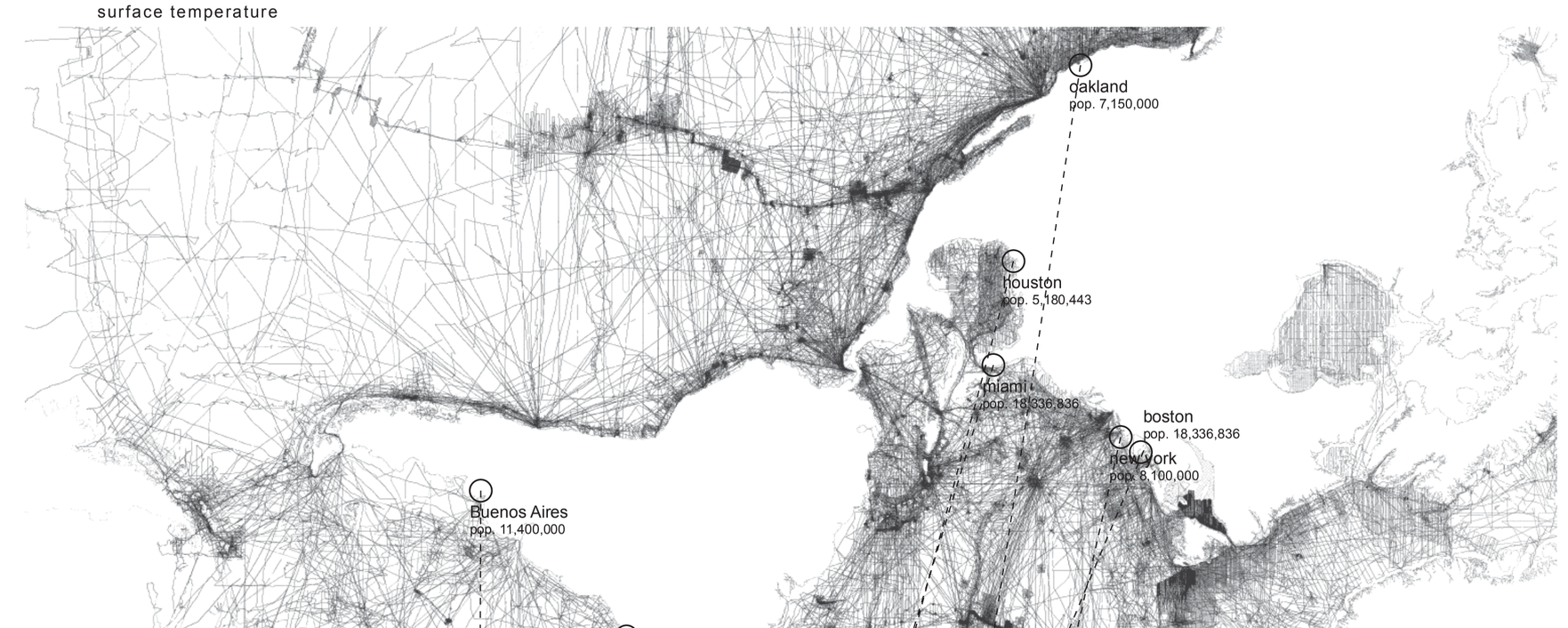
temperature heat exchange

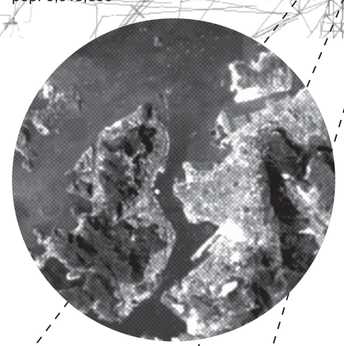


pressure

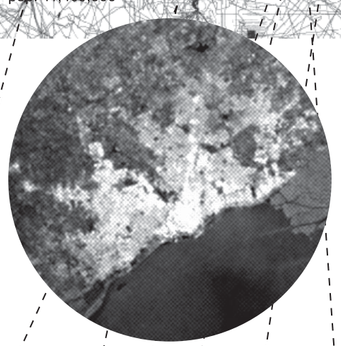


surface temperature

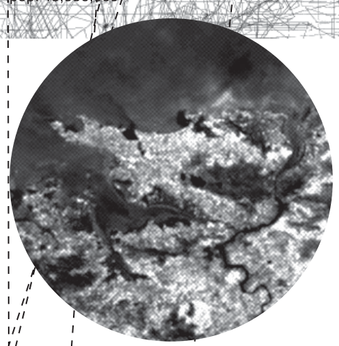


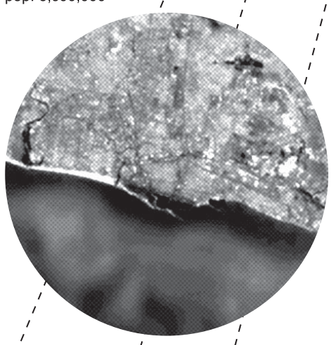
Chennai, India
pop. 6,900,000

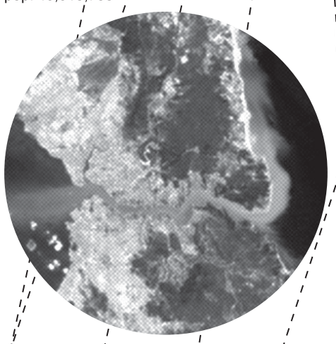


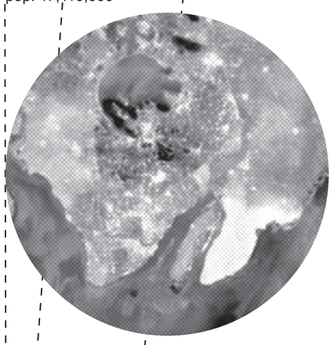
İstanbul, Turkey
pop. 10,018,735



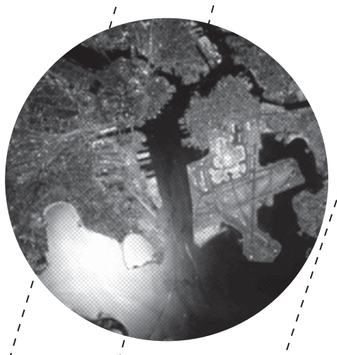
Shanghai, China
pop. 17,110,000



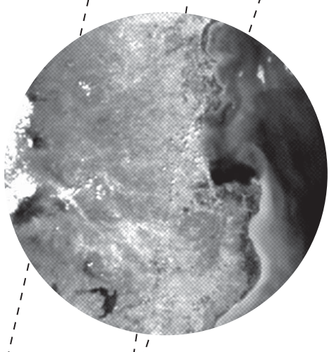




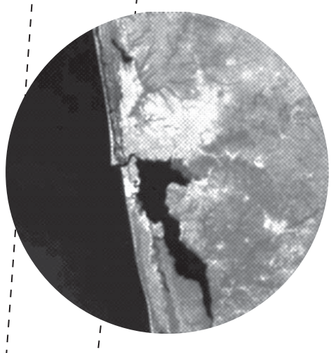
Boston, MA, USA
pop. 5,800,800



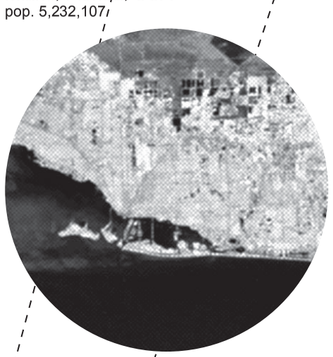
Jakarta, Indonesia
pop. 8,792,000



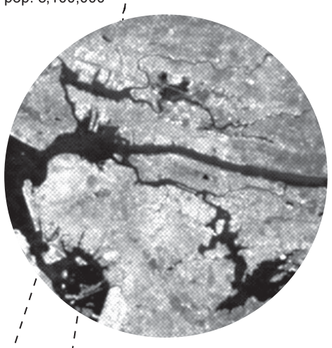
Lagos, Nigeria
pop. 15,000,000



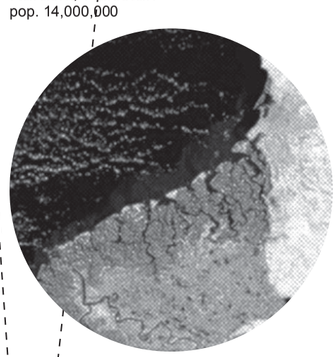
Miami, Florida, USA
pop. 5,232,107



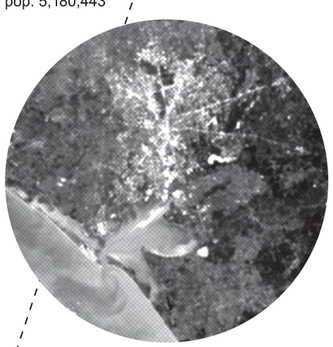
New York City, USA
pop. 8,100,000



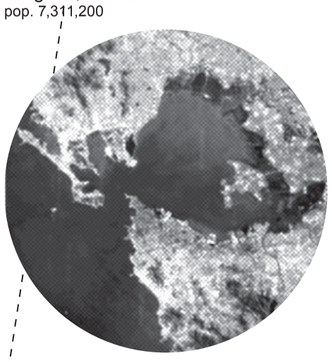
Karachi, Pakistan
pop. 14,000,000



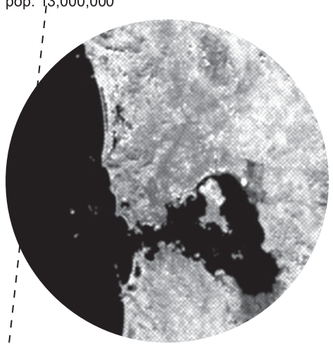
Houston, TX, USA
pop. 5,180,443



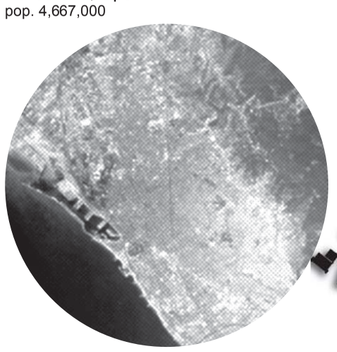
Qingdao, China
pop. 7,311,200



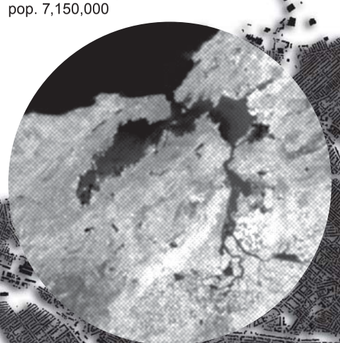
Rio de Janeiro, Brazil
pop. 13,000,000



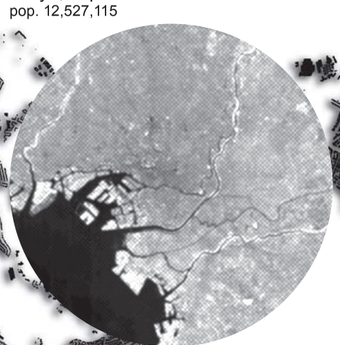
Barcelona, Spain
pop. 4,667,000

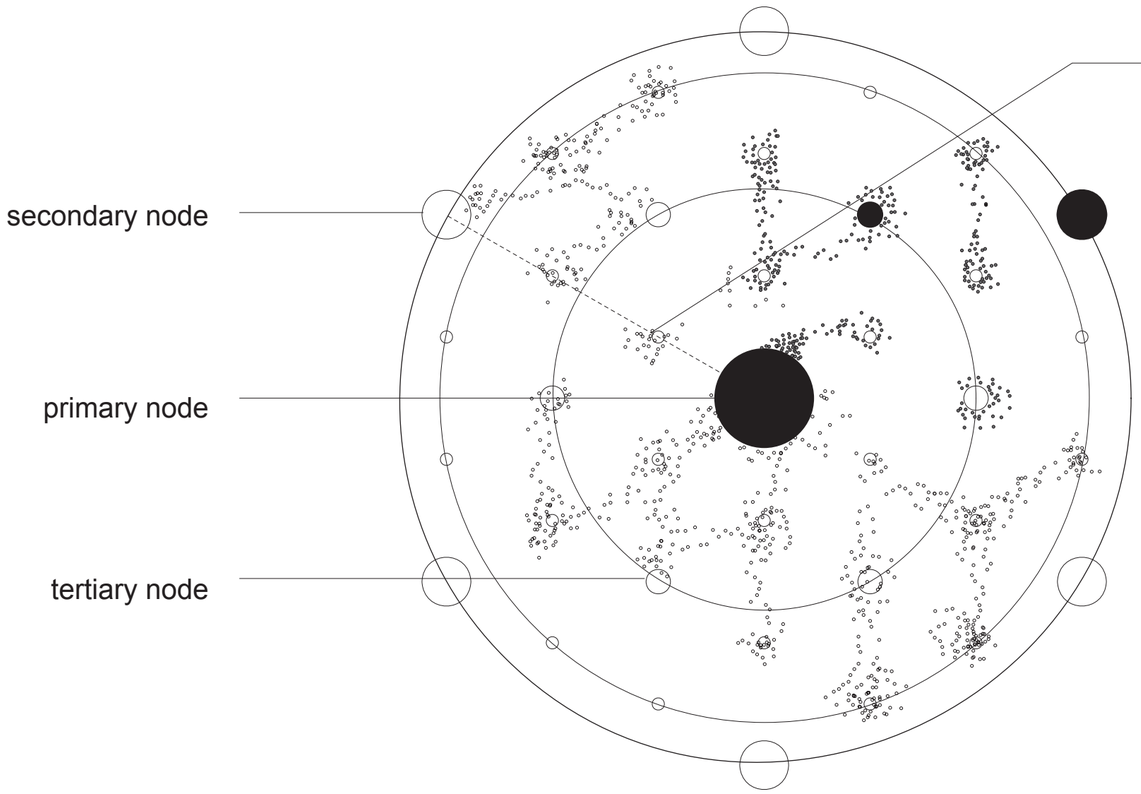


Oakland, CA, USA
pop. 7,150,000

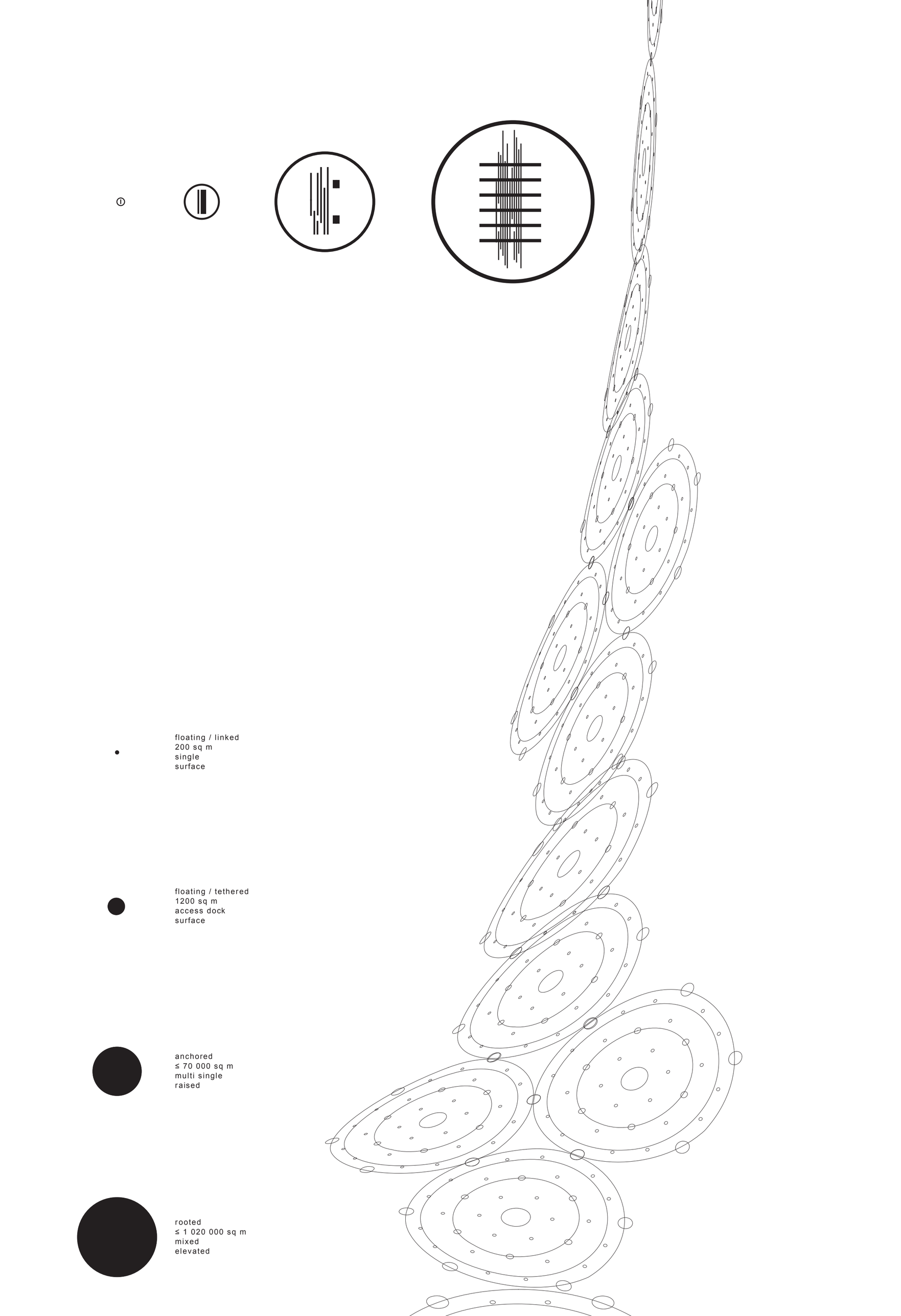


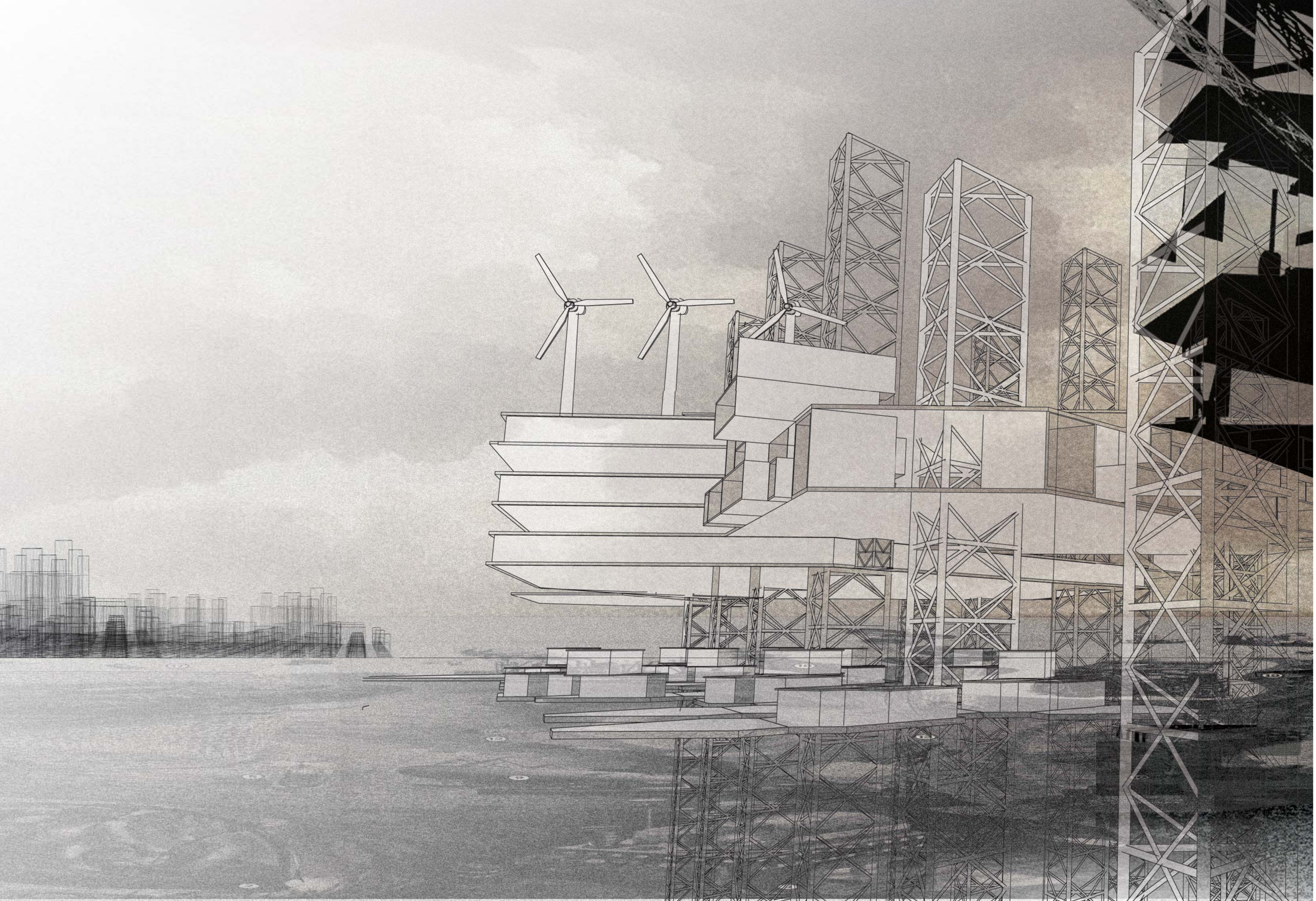
Tokyo, Japan
pop. 12,527,115






avg. distance = 500m
= 10 min. walking
= 5 min. biking
= 3 min. by boat


floating / linked
200 sq m
single
surface
floating / tethered
1200 sq m
access dock
surface
anchored
≤ 70 000 sq m
multi single
raised
rooted
≤ 1 020 000 sq m
mixed
elevated

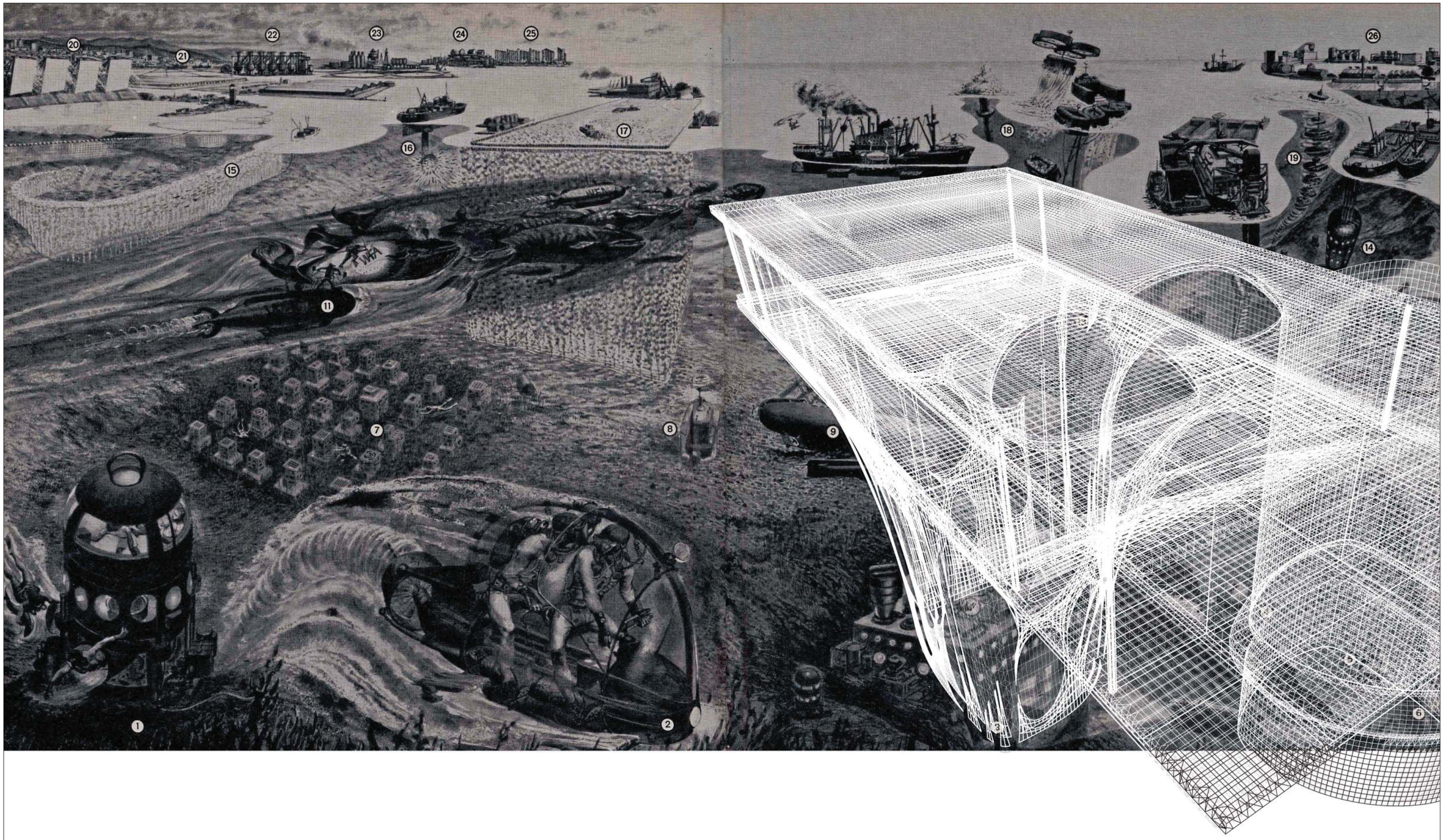



1960
1970
1980
1990
2000
2010


2010
2020
2030
2040
2050
2060

appendix a

HOUSING CASE STUDY
Flood Resistant Housing; Deventer, NL

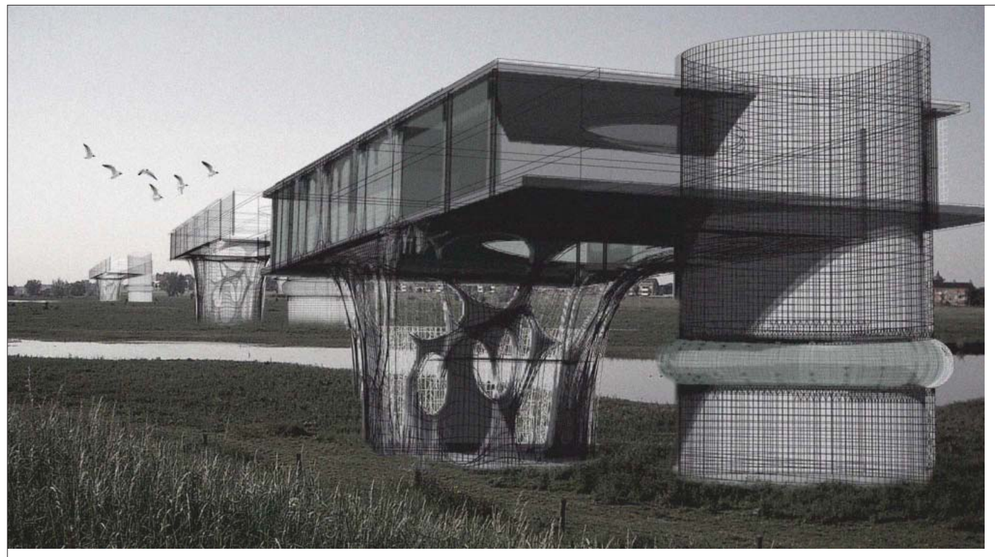



# the T house

## rotation prototype II

Talia Dorsey
Yoon Kyung

2005



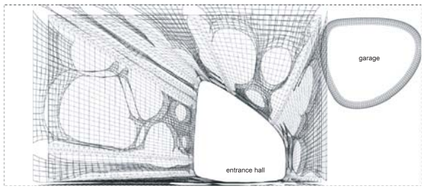
# the T house

## rotation prototype II

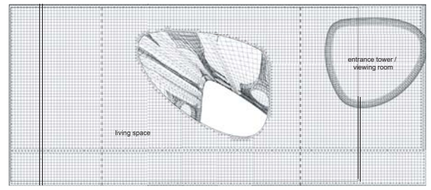
Talia Dorsey
Yoon Kyung
::
June 2005

**Where the Dutch tradition of vertical living meets the absolute horizontality of its landscape, the T house is a housing prototype designed to qualitatively shift axes as dry times turn to flood times : renaturing itself according to the nature of the terrain below.**

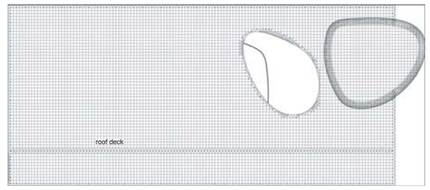
**In dry times, the T house is a constructed landscape orienting life along the vertical axis - allowing light, air and access to all levels through the vertical spaces of occupation. In flood times, the T house, in its light, function, access and appearance is transformed into a purely horizontal space, designed to reorient the occupant in tandem with the water horizon below.**




plan - ground level




plan - level 1

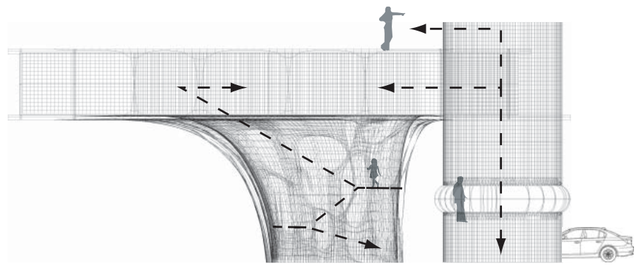


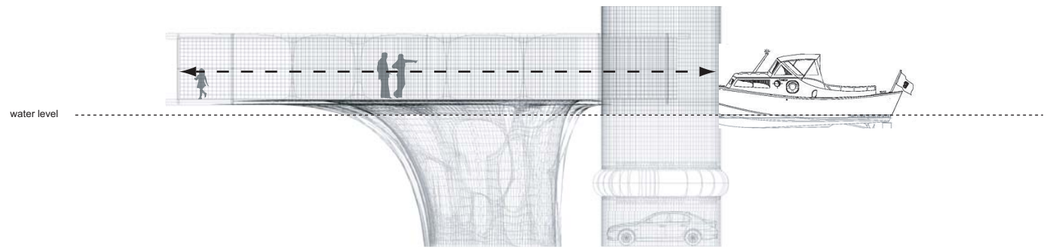

plan - roof

## SUMMER

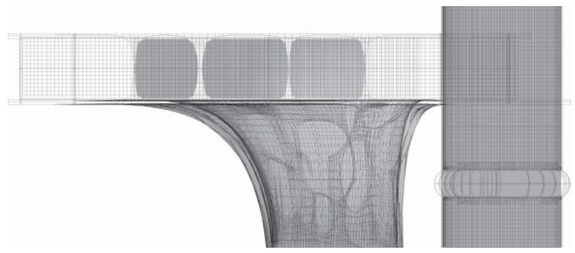
## WINTER

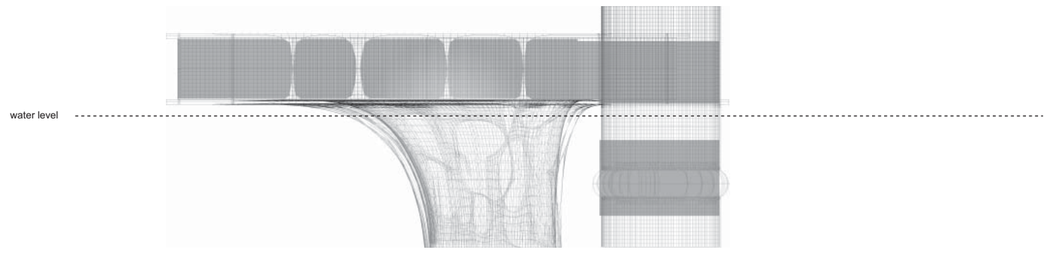
**CIRCULATION**



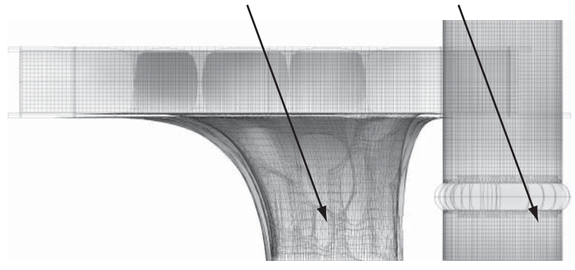


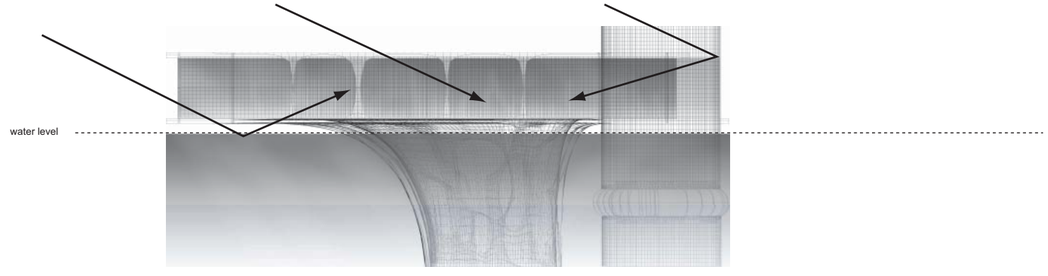

**LIVING**






**LIGHT**






appendix b

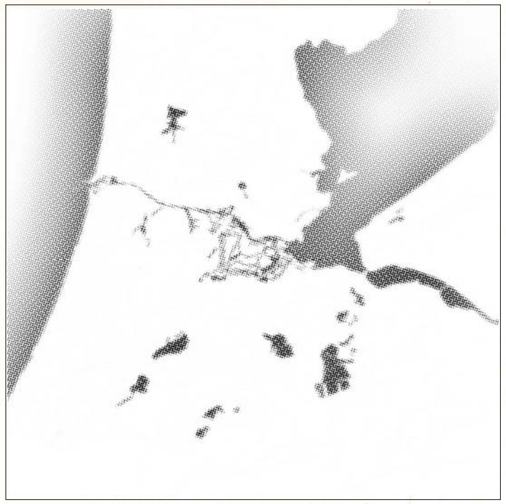
URBAN CASE STUDY
Hydor-Urbanism Experimental Base; Nieuwe Meer, NL

# m / c

For seven hundred and fifty years, the Dutch have been making land out of water – forging their territory with dikes, dams, locks and levees. However, as the millenium turned, the Ministry of Transport, Public Works and Water Management recognized the instability and unsustainability of such methods in the face of increasingly rising sea levels. In 2001, the Ministry officially announced their “Making Room for Water” plan – a final turn from tradition, a plan to give land back to the water.

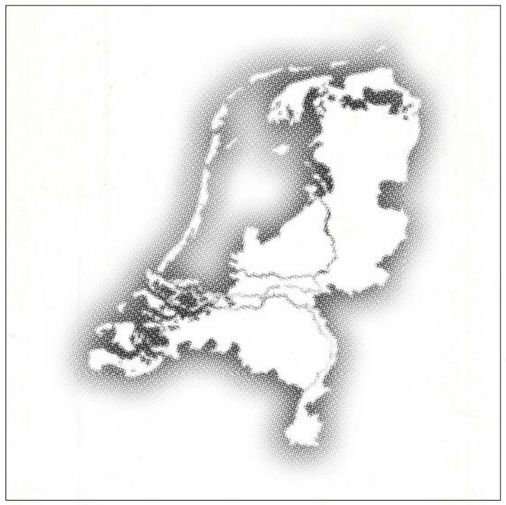
However, perhaps such a turn need not be absolute. While the tides turn back in the future perhaps too might the Dutch have to consider an inversion of their own tradition - to make land out of water by making water itself the new land.

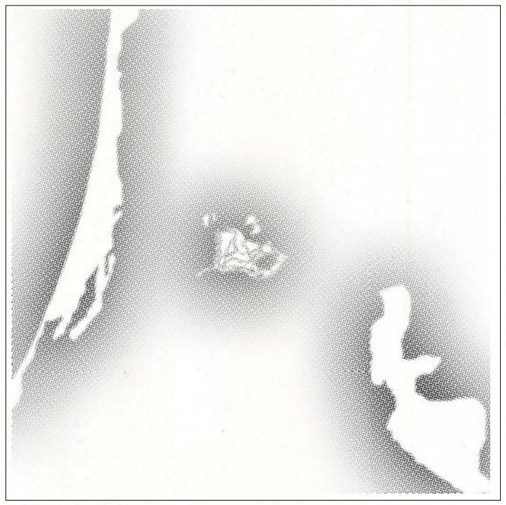
the Netherlands



Amsterdam

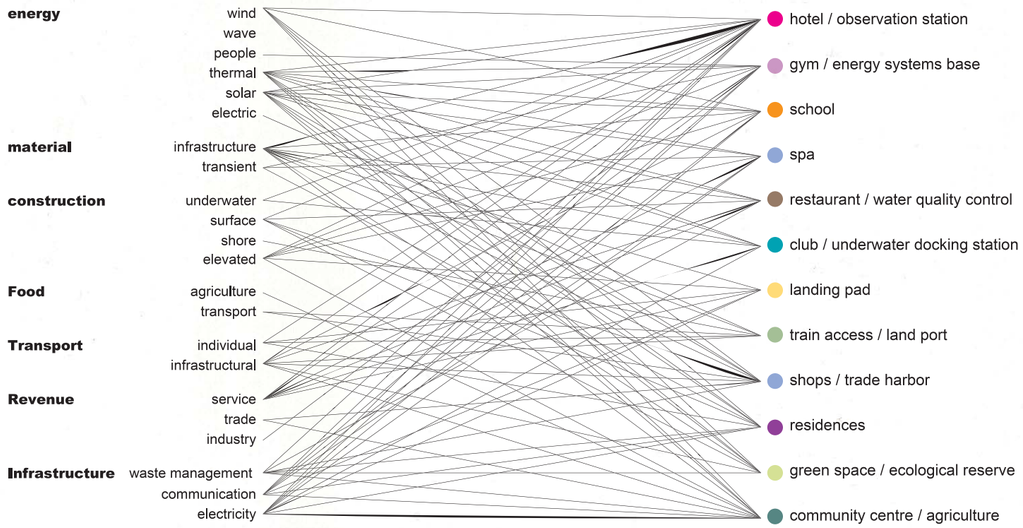
Nieuwe Meer



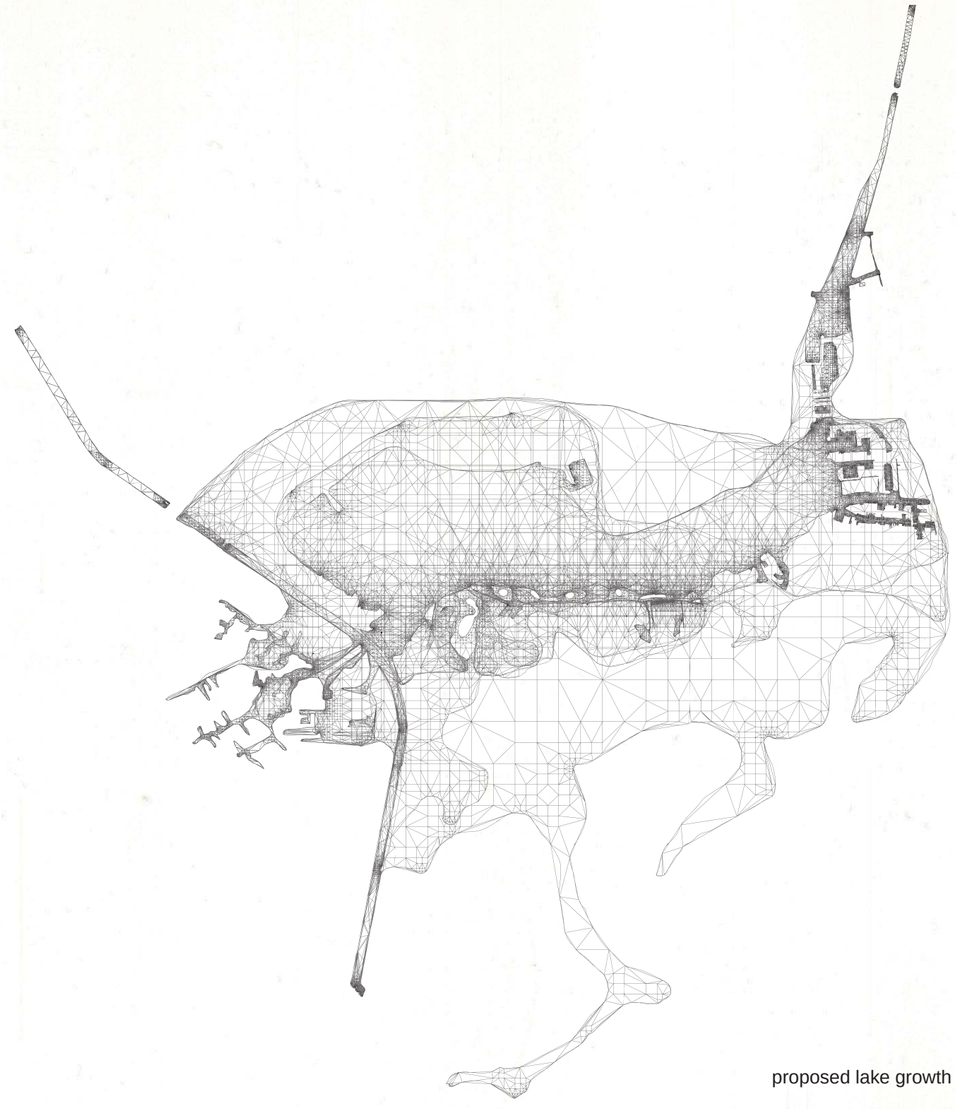


The site of Nieuwe Meer is taken as a test site – a controlled body of water, with controlled parameters of existence. A microcosmic case study is planned – over the course of fifty years the hope is that a self-sustaining community might develop. Its intention is to provide an experimental testbed of activity for the monitoring, understanding and testing of feasibility, human settlement patterns and sustainability criteria for future water-based dwelling schemes.

The fifty year project is envisioned as a whole; however, its growth patterns are hypothesized and only the anticipatory immediate is considered firm. The elements considered for planned construction are the initial critical catalysts designed to support ongoing growth, and the reshaping and controlled flooding of the lake and its surroundings.

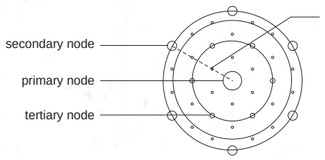



programmatic and functional scheme



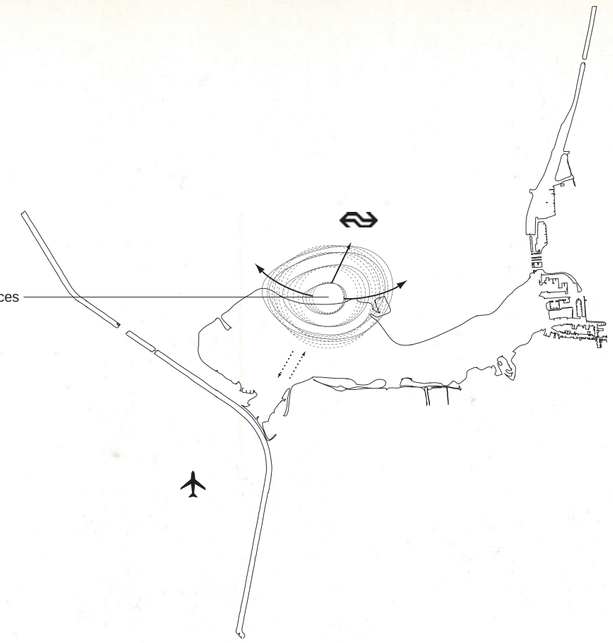
proposed lake growth

# envisioned growth models




avg. distance = 500m
= 10 min. walking
= 5 min. biking
= 3 min. by boat

idealized growth model



phase 1 growth zone and distortion forces

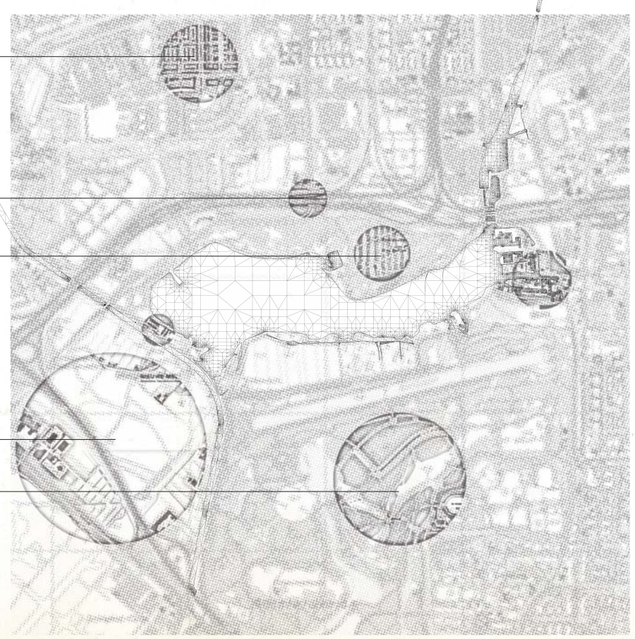
phase 2 hypothesized growth zone and distortion forces

human settlement

lake contour

0 yrs.

10 yrs.



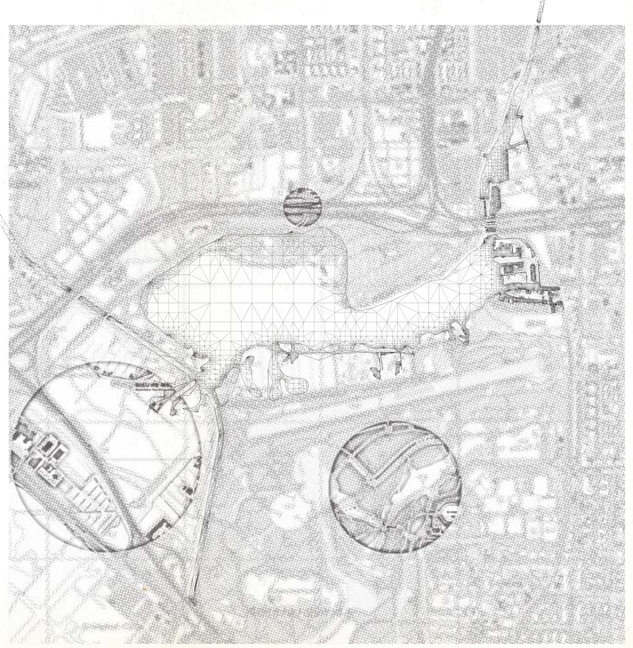
social housing community

site for planned route/rail station

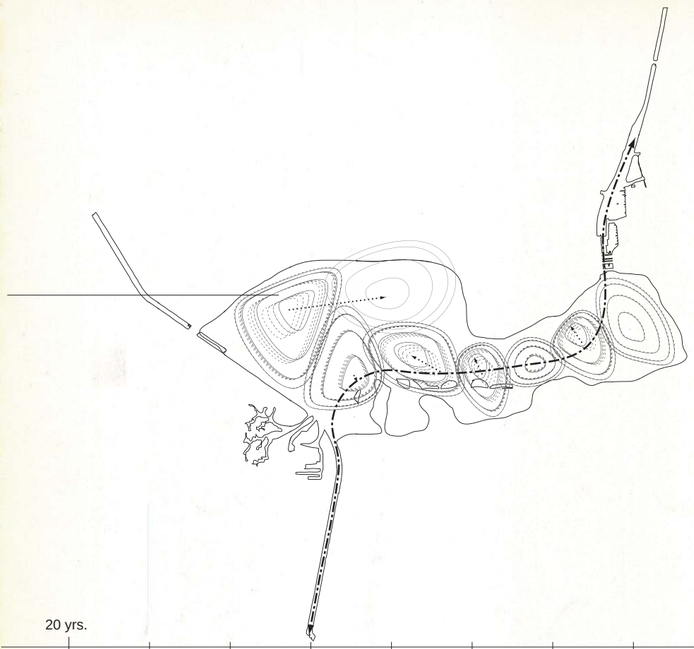
garden plots

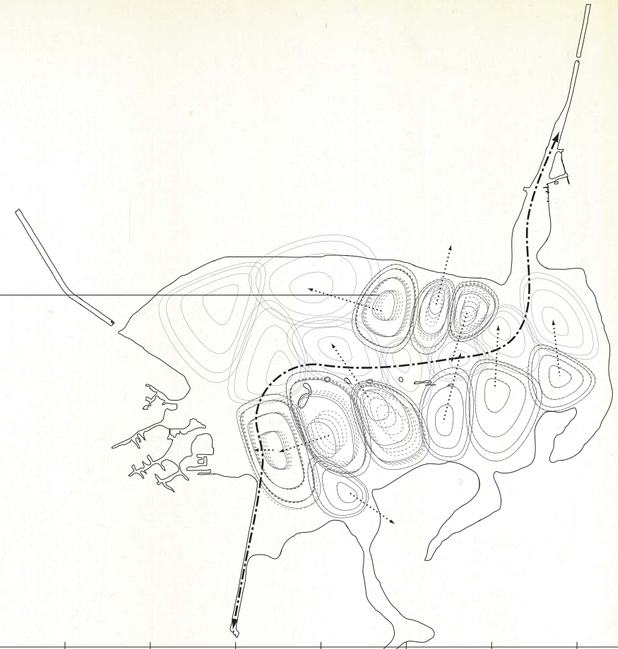
Schiphol Airport

Amsterdamse Bos



phase 3 hypothesized growth zone and distortion forces



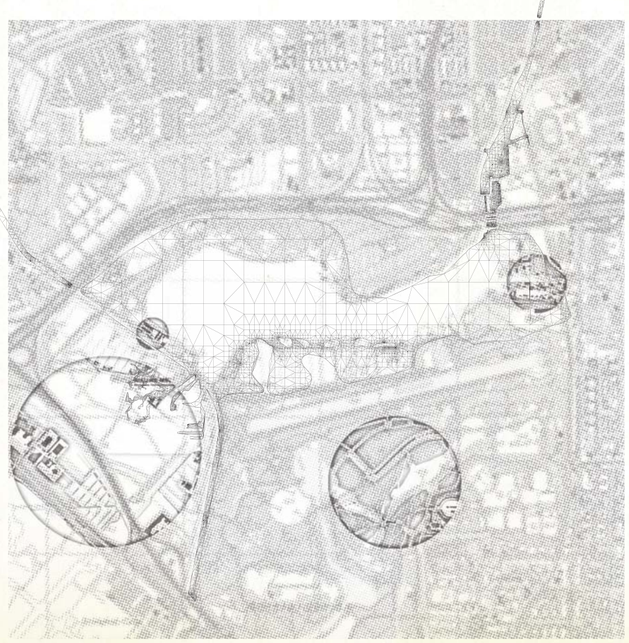


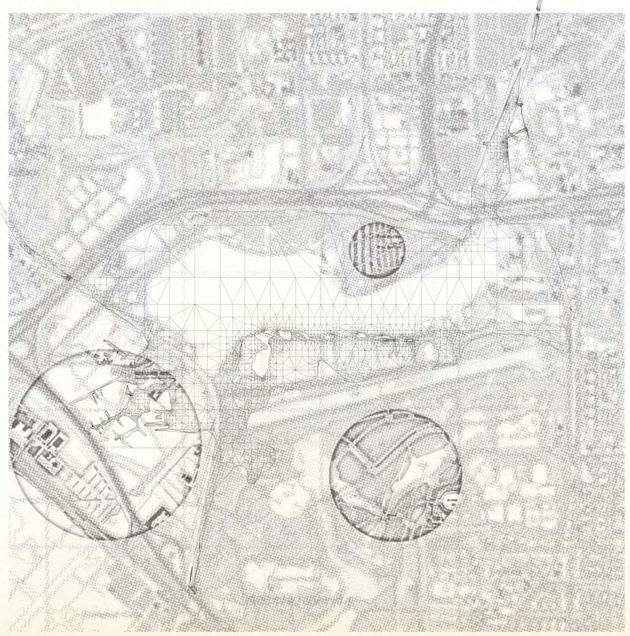
20 yrs.

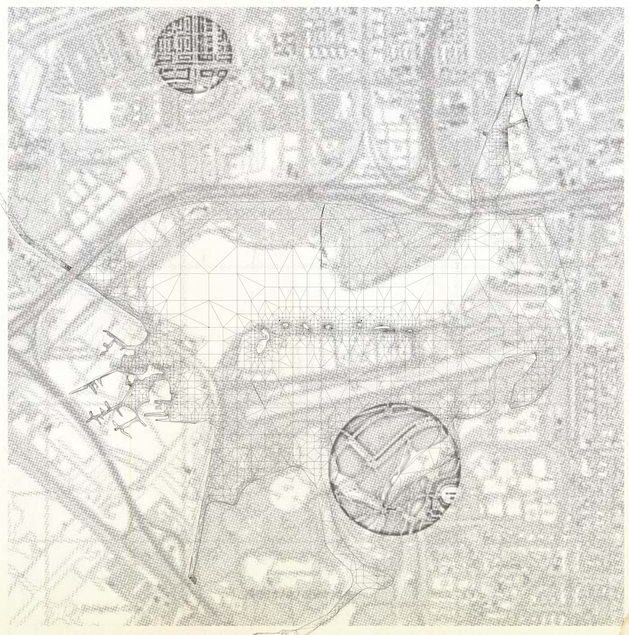
30 yrs.

40 yrs.

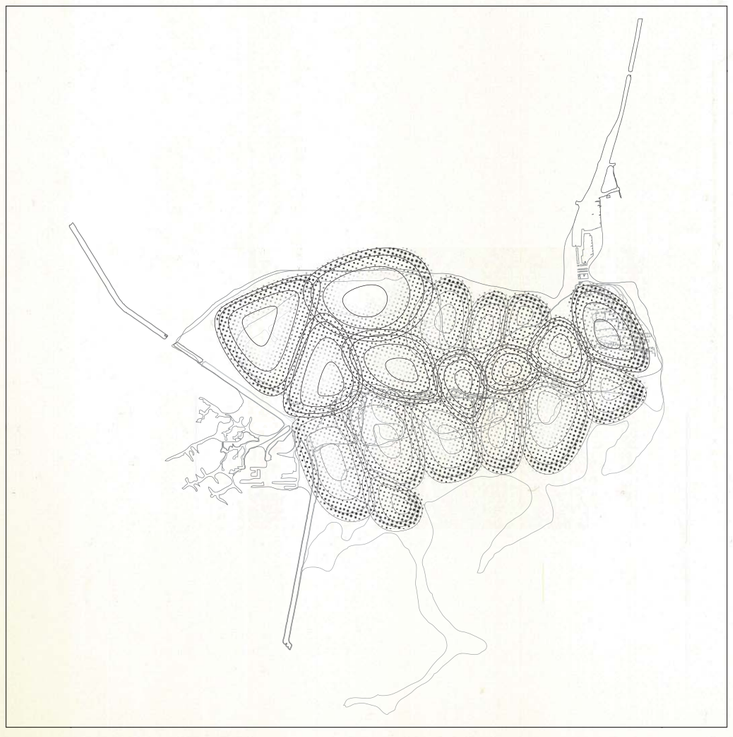
50 yrs.



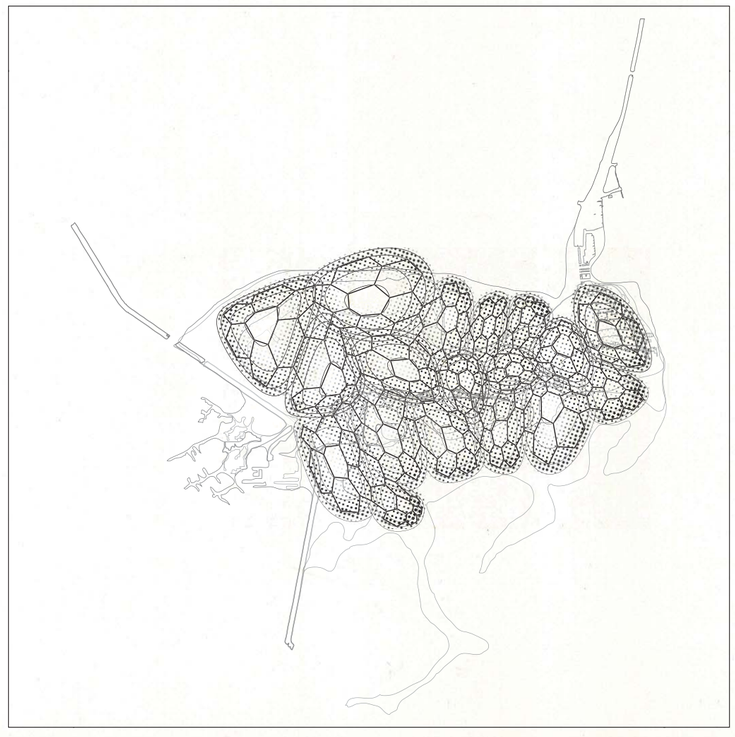




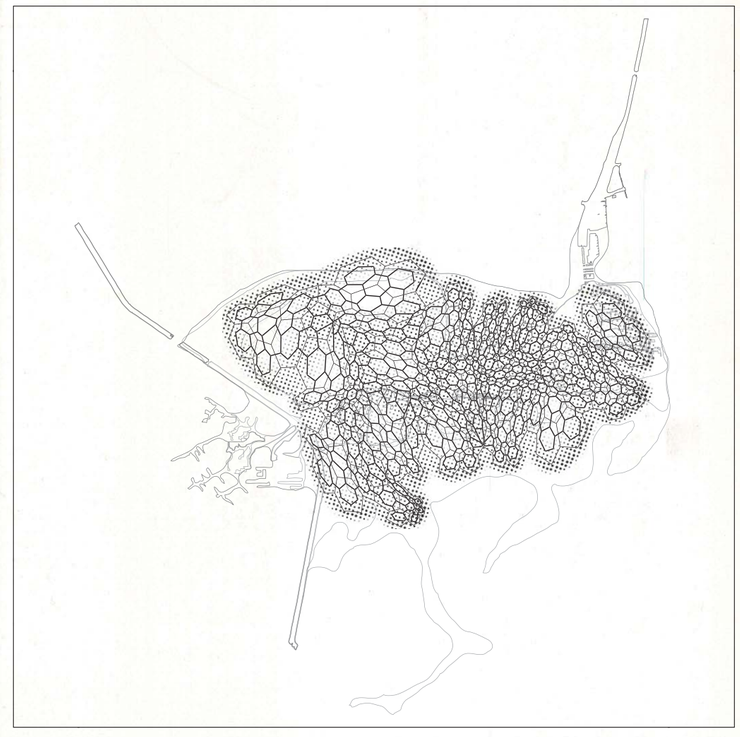
hypothesized
settlement
patterns



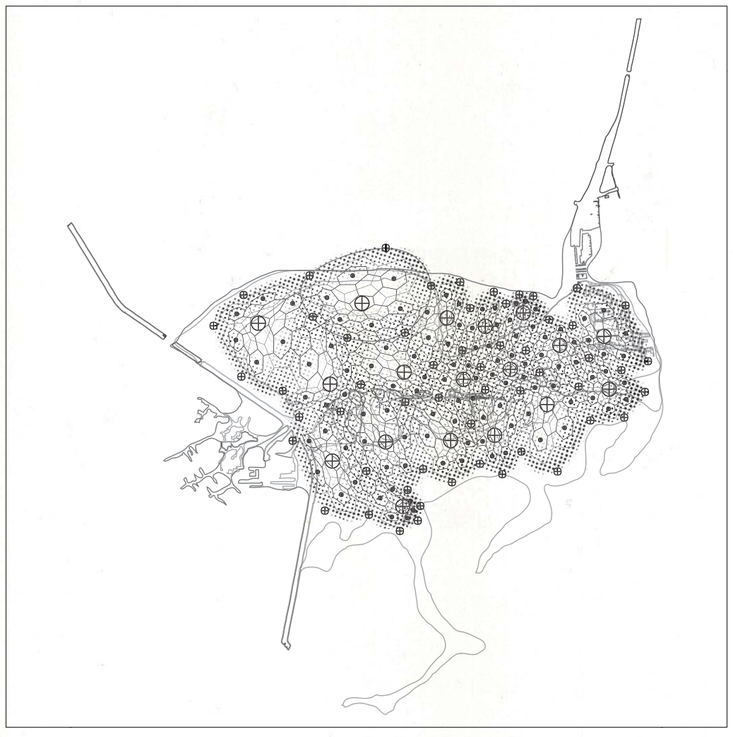
nodal growth



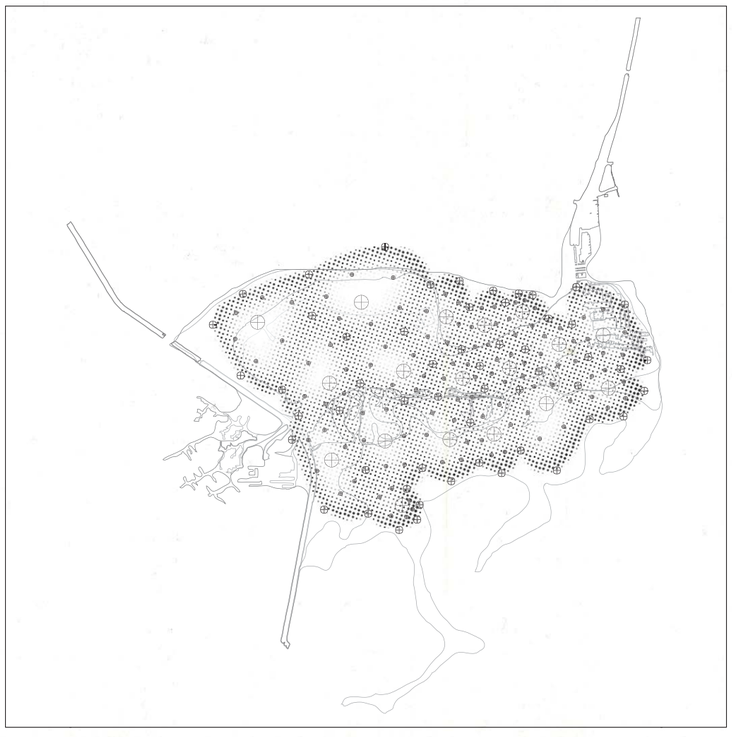
hexagonal cell structure



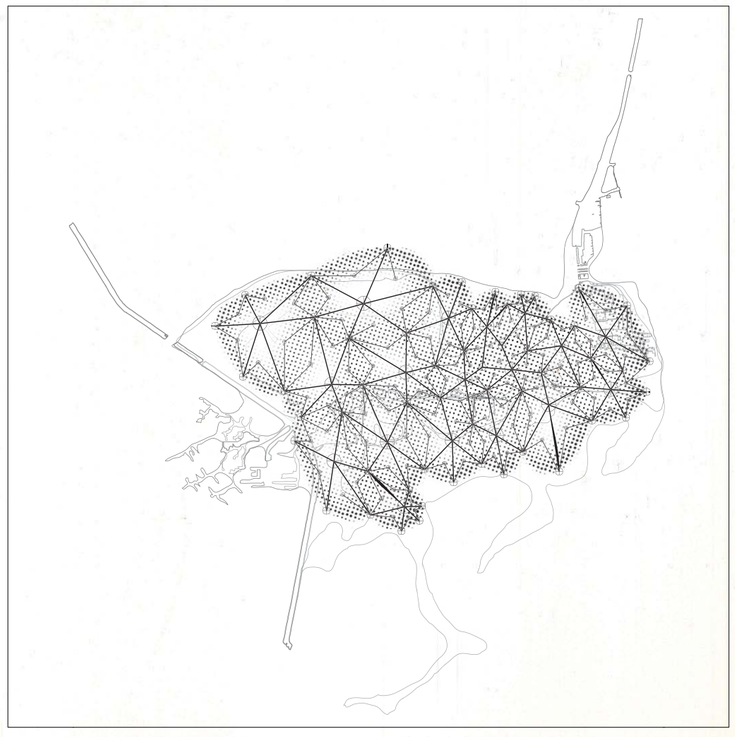
secondary hexagonal cell structure



primary, secondary and tertiary nodes

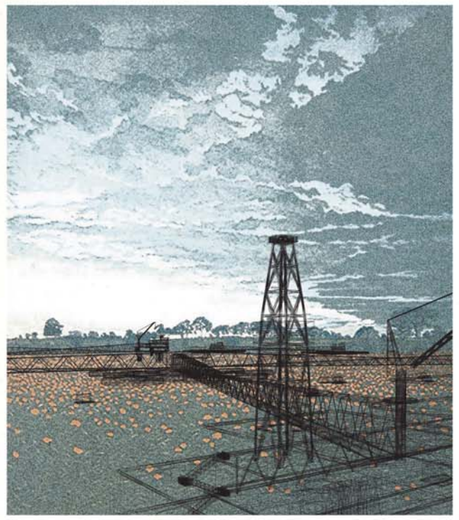


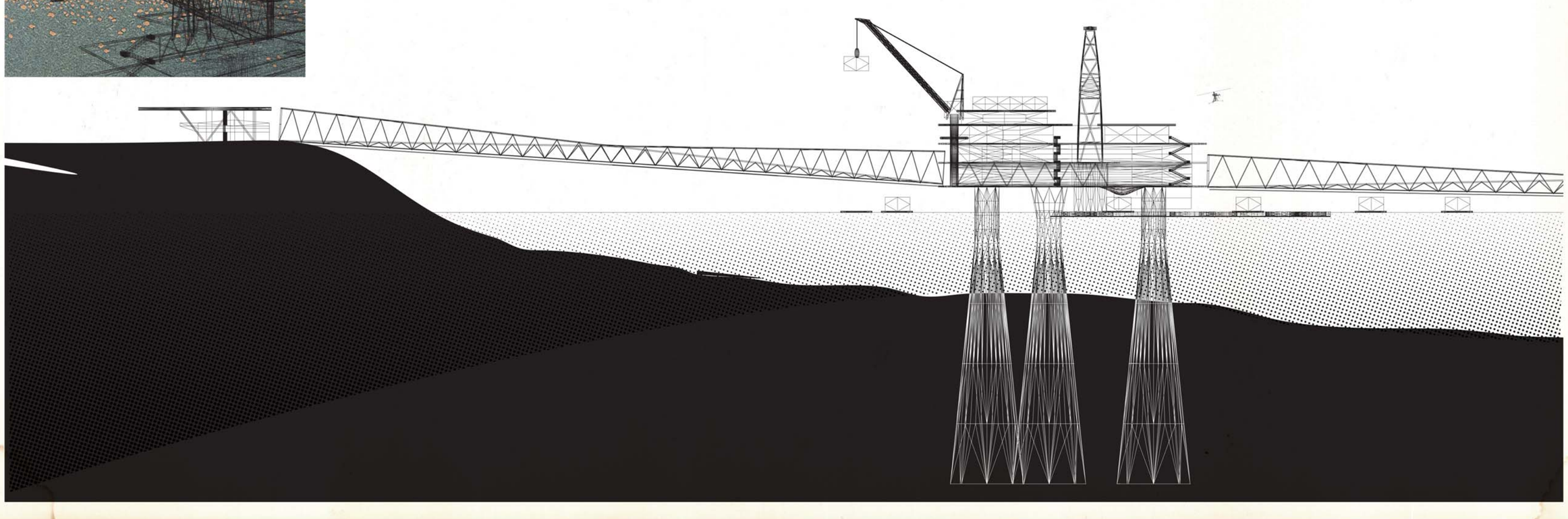
primary, secondary, and tertiary nodal organization

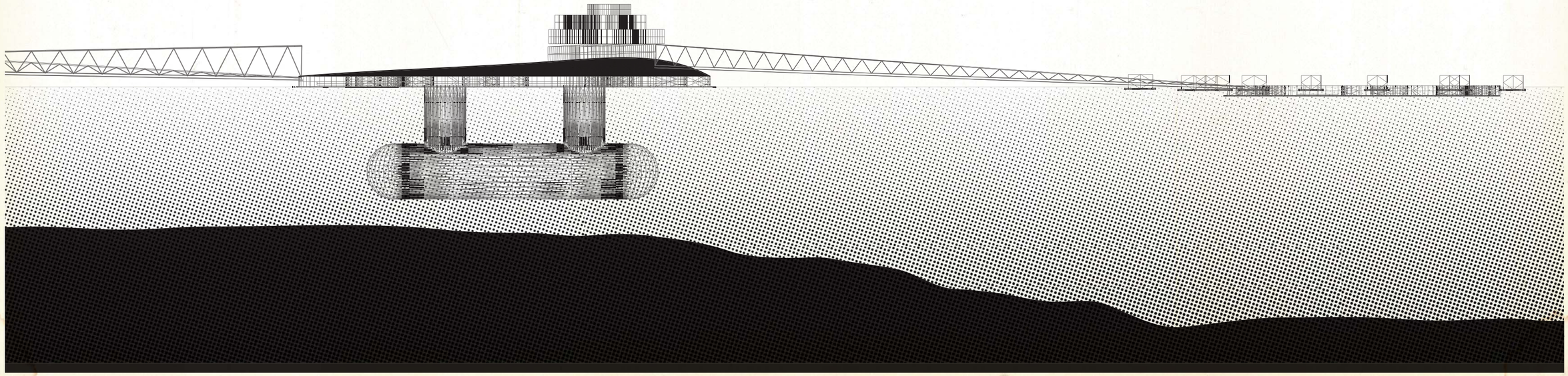


connection scheme

phase 1
schematic
design







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